



2000 On-Road Mobile Source Episode-Specific Emissions Inventories For the Houston/Galveston Ozone Nonattainment Area

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TECHNICAL NOTE

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SUBJECT: 2000 On-Road Mobile Source Episode-Specific Emissions Inventories for the
Houston/Galveston Ozone Nonattainment Area
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INTRODUCTION

This Technical Note documents the methods that the Texas Transportation Institute (TTI) used to develop the Houston/Galveston ozone nonattainment area (HGA) 2000 base case ozone episode on-road mobile source emissions inventories (EI), a task in support of the HGA ozone State Implementation Plan Mid-Course Review requirement. (There is also a 2007 attainment date episode EI analysis associated with this task which is documented separately.) The HGA counties are: Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, Waller. The ozone episode period for these EIs is 20 days: August 18 through September 6.

Emissions of volatile organic compounds (VOC), carbon monoxide (CO), and oxides of nitrogen (NO_x), are estimated for each day on an hourly basis. The hourly estimates are computed by network link for the provided geographical coordinates. Emissions are categorized by 28 vehicle types and 14 pollutant-specific emissions types.

Documented within are the methods relating to calculating the inventory elements including link-based vehicle miles traveled (VMT) estimates from Houston/Galveston Area Council's (HGAC) travel demand model (TDM), August day-of-week-adjusted Highway Performance Monitoring System (HPMS) VMT control totals, VMT mix, speeds, MOBILE6 emissions factors, and the emissions estimates.

ACKNOWLEDGMENTS

Mary McGarry-Barber and Chris Kite, both with the Texas Commission on Environmental Quality (TCEQ), and Martin Boardman and L.D. White, both of the Texas Transportation Institute (TTI), contributed to the development of the MOBILE6 emissions factors input data parameter values. Boardman produced the MOBILE6 model set-ups used, and performed the emissions factors analyses. Chris van Slyke of HGAC provided the 2000 Houston/Galveston area network traffic assignment and intrazonal trips. Dennis Perkinson, Ph.D., of TTI, developed seasonally adjusted HPMS VMT control totals and VMT mix. White prepared VMT and modeled operational speeds. Boardman performed the emissions estimations. Each member of the assigned TTI staff contributed to the quality assurance of the emissions inventory elements. Dr. Perkinson was the principle investigator for this project. This work was performed by TTI under contract to TCEQ. Mary McGarry-Barber was the TCEQ project technical manager.

Deliverables

Interim deliverables are an informal Technical Note (a narrative in memorandum format that explains the task, the approaches used, and the findings) provided to the Project Manager in WordPerfect 6/7/8 format, which is supported by electronic document files. All pertinent data are being submitted in specified electronic format. (There is no FORTRAN source code or executable files developed under this task.) CD-ROM is used to record the final data and supporting documentation. TTI is providing five copies of the final report. One of the copies is an unbound original suitable for copying. Electronic copies of all materials related to the task report, to document results and conclusions (e.g., data, work files, text files, etc.), or developed as work products under this contract are provided as requested by the TCEQ staff.

The 2000 ozone episode base-case emissions inventory datasets on CD-ROM were submitted in two parts to the TCEQ Technical Analysis Division on July 28 and July 30, 2003. Appendix A lists the CD-ROM volume names and the data set file names and descriptions contained on each CD.

SUMMARY OF VMT AND EMISSIONS

A summary of 24-hour HGA network total VMT, average speed, and emissions for the 20 analysis days is presented in Table 1.

Table 1
HGA All Counties August 2000 Ozone Episode Day
On-Road Mobile Source VMT, Average Speed (mph), and Emissions (tons per day)

Day	VMT	Speed	VOC	CO	NOx
Friday, August 18	139,452,589	39.2	162.1	2,232.5	311.3
Saturday, August 19	115,955,895	40.9	118.0	1,770.0	207.7
Sunday, August 20	96,113,092	42.0	98.3	1,521.6	149.9
Monday, August 21	127,460,894	40.1	146.1	2,053.3	351.6
Tuesday, August 22	127,460,894	40.1	139.8	1,985.0	345.1
Wednesday, August 23	127,460,894	40.1	137.9	1,934.9	344.2
Thursday, August 24	127,460,894	40.1	137.7	1,929.7	343.7
Friday, August 25	139,452,589	39.2	158.2	2,206.8	304.3
Saturday, August 26	115,955,895	40.9	117.1	1,774.6	204.3
Sunday, August 27	96,113,092	42.0	97.4	1,520.0	148.2
Monday, August 28	127,460,894	40.1	145.5	2,052.0	350.6
Tuesday, August 29	127,460,894	40.1	147.2	2,072.3	350.7
Wednesday, August 30	127,460,894	40.1	151.1	2,110.8	356.7
Thursday, August 31	127,460,894	40.1	156.3	2,160.8	362.3
Friday, September 01	139,452,589	39.2	168.6	2,340.6	312.0
Saturday, September 02	115,955,895	40.9	124.3	1,903.7	209.4
Sunday, September 03	96,113,092	42.0	105.0	1,612.4	157.8
Monday, September 04	127,460,894	40.1	158.4	2,196.8	362.9
Tuesday, September 05	127,460,894	40.1	155.4	2,167.1	359.2
Wednesday, September 06	127,460,894	40.1	142.3	1,945.0	355.9

OVERVIEW OF METHODOLOGY

To develop the HGA ozone episode emissions estimates, a directional link-based, hourly methodology was applied. Emissions estimates were calculated at the roadway network link level for each hour of each analysis day.

The MOBILE6 model (EPA, October 2002) was used to develop hourly emissions factors by MOBILE6 road type (or drive cycle) and 28 vehicle types. The speed sensitive freeway and arterial emissions factors, and the fixed-speed ramp emissions factors were used — composite

freeway-freeway ramp emissions factors applied to freeway links (using EPA default allocation 92 percent freeway and 8 percent ramp), and arterial drive cycle emissions factors to non-freeway links. The activity basis was the Houston/Galveston directional TDM link-based and intrazonal VMT, adjusted to August 2000 day-of-week HPMS VMT control totals. Automatic traffic recorder (ATR) data were used to produce the seasonal (August) day-of-week VMT adjustment factors. Hourly travel fractions were applied to allocate the August day-of-week VMT by hour-of-day. Hourly, directional, average operational speeds (congested speed estimates based on estimated volume-to-capacity [v/c] ratios) were modeled by link. Vehicle classification data were used to estimate time-of-day VMT mixes for apportioning fleetwide link VMT for three road type groups to the 28 U.S. Environmental Protection Agency (EPA) vehicle types. Link-level emissions by vehicle type were calculated by hour. For the geographical allocation of emissions, the link endpoints (designated by network node numbers for which X-Y coordinates are provided) were recorded with the hourly link emissions.

TTI previously developed a series of computer programs to develop detailed on-road mobile source emissions inventories. These computer programs were used to produce and apply the major emissions inventory elements (adjusted operational time-of-day link VMT by vehicle type, operational link-speeds, VMT mix, and MOBILE6 emissions factors) to calculate the emissions estimates. Appendix B describes these programs and their application.

ESTIMATION OF VMT

The outputs of the VMT estimation process are estimates of county VMT (and speeds, as discussed in a following section) by day-of-week (average Monday through Thursday, Friday, Saturday, and Sunday), hour, and direction for each link of the Houston/Galveston TDM network and for each of the added intrazonal links. For each county, link-based VMT estimates were adjusted to consistency with the 2000 HPMS VMT, August 2000 day-of-week activity control total for that county. The adjusted VMT were then allocated by hour of day. The HGAC traffic assignments were directional traffic assignments.

For each county, there are four VMT estimates, Friday VMT, Saturday VMT, Sunday VMT, and Weekday (average Monday through Thursday) VMT.

Data Sources

The HGA 2000, directional four time-of-day period, equilibrium traffic assigned network and intrazonal trips and zonal radii (assumed intrazonal trip length) were provided by HGAC. These TDM data, which cover the HGA eight county area, were used as the basis for developing the link-based August 2000 episode VMT estimates. Because the intrazonal trips are not assigned to the network, the intrazonal trips and zonal radii were needed to estimate the intrazonal VMT. To adjust the 2000 Houston/Galveston TDM VMT and allocate it as needed for the August 2000 episode days, several other sources of data were required.

HPMS VMT estimates are based on traffic count data collected according to a statistical sampling procedure specified by the Federal Highway Administration (FHWA) designed to estimate VMT. A wide range of traffic data is collected under the HPMS program. For the purpose of this study, county total HPMS Annual Average Daily Traffic (AADT) VMT were

used to ensure that by county, travel model VMT were consistent with the HPMS VMT estimates. (EPA and FHWA have endorsed HPMS as the appropriate source of VMT and require that VMT used to construct on-road mobile source emissions inventories be consistent with that reported through HPMS.)

ATR vehicle counts are collected by the Texas Department of Transportation (TxDOT) at selected locations on a continuous basis throughout Texas. These counts are available by season, month, and weekday, as well as on an annual average daily basis (i.e., AADT). Since they are continuous, they are especially well suited for making seasonal, day-of-week comparisons (i.e., adjustment factors), even though there may be relatively few ATR data collection locations in any given area. Data from the ATR stations in the HGA were grouped for this analysis. These ATR count data were used to produce the August day-of-week adjustment factors.

HGA time-of-day factors from previous HGA emissions inventory analyses were processed to estimate the hourly travel fractions for this study. (TXDOT vehicle classification count data were used to develop the VMT mix, or VMT fractions, for the 28 EPA vehicle types, discussed in a following section.)

August 2000 Day-of-Week VMT Control Totals

To produce August day-of-week-specific, 2000 HPMS consistent link-based VMT, VMT control totals were used. ATR-based August day-of-week adjustment factors were developed and applied to each county's 2000 HPMS AADT VMT estimate. The results, presented in Table 2, are four August 2000 VMT control totals for each county; one each for Weekday, Friday, Saturday, and Sunday VMT estimates. These control totals (by county) were disaggregated to the link level proportional to the HGA TDM VMT on each link.

Aggregated ATR data (for 1999 and 2000) from the HGA ATR-stations were used. The eight-county area August day-of-week factors were produced by dividing the average day-of-week traffic count by the AADT traffic count. The August day-of-week factors are: Weekday 1.05802, Friday 1.15756, Saturday 0.96252, and Sunday 0.79781.

Table 2
HGA County August 2000 VMT Control Totals*

County	AADT	Weekday**	Friday	Saturday	Sunday
Brazoria	5,284,407	5,591,009	6,117,019	5,086,348	4,215,953
Chambers	2,081,471	2,202,238	2,409,428	2,003,458	1,660,619
Fort Bend	6,418,376	6,790,770	7,429,656	6,177,815	5,120,645
Galveston	5,822,246	6,160,052	6,739,599	5,604,028	4,645,046
Harris	90,459,224	95,707,668	104,711,979	87,068,812	72,169,273
Liberty	1,923,087	2,034,664	2,226,089	1,851,010	1,534,258
Montgomery	6,856,031	7,253,818	7,936,267	6,599,067	5,469,810
Waller	1,626,312	1,720,671	1,882,554	1,565,358	1,297,488
HGA	120,471,154	127,460,890	139,452,591	115,955,896	96,113,092

* Rounded to whole numbers

** Average Monday through Thursday

Thus, four control-total consistent, link-VMT data sets were produced for each county. The TDM assignment link VMT were adjusted to control total consistency on a county basis by multiplying the VMT on each link by the ratio of the control total VMT to the TDM assignment total VMT.

Hourly Travel Factors

Hourly time-period volume factors developed for a previous HGA air quality analysis were processed to produce factors for apportioning VMT by hour for this analysis.

Previously, time-of-day volume factors were applied to apportion HGA TDM VMT from a single 24-hour assignment to the hours (24) of the day (HGA MOBILE5b 2007 emissions analysis, TTI, December 2000). The single assignment hourly volume factors are a set of factors by 24 time periods, five HGA TDM area types (see Table 3), the 13 HGA TDM network functional classes (see Table 4), and the four day-of-week periods. The VMT factors may be grouped by four area types by combining Central Business District and Urban area types (Table 3) and by three functional groups (Table 4).

Table 3
HGA Network Area Types

Central Business District (CBD)
Urban
Urban Fringe
Suburban
Rural

Table 4
HGA Functional Classification to Functional Group Table of Equals
for Application of Hourly VMT Factors

Functional Group	Network Functional Classifications
Freeways, Interstates	1. Urban Interstate Freeways 2. Urban Other Freeways 10. Rural Interstate Freeways 11. Rural Other Freeways
Arterials, Major Collectors	5. Urban Principal Arterials 6. Urban Other Arterials 12. Rural Principal Arterials 13. Rural Other Arterials 14. Rural Major Collectors
Collectors, Locals	7. Urban Collectors 8. Locals (Centroid Connectors) 15. Rural Collectors 16. Locals (Intrazonals)

For this August 2000 base-case analysis, HGAC provided a four-period time-of-day 2000 network assignment. Table 5 shows the assignment time-of-day travel periods.

TABLE 5
HGA Time-of-Day Travel Periods

Period	Hours
AM Peak	6:00 a.m. - 9:00 a.m.
Mid-Day	9:00 a.m. - 3:00 p.m.
PM Peak	3:00 p.m. - 7:00 p.m.
Overnight	7:00 p.m. - 6:00 a.m.

To produce the hourly volume fractions for allocating the four-period 2000 assignment VMT to the hours of day, the hourly factors (from the prior single assignment analysis) by area type and functional group were grouped within their corresponding four time-of-day periods and then normalized within each period. This procedure was performed on the prior 24-hour assignment hourly volume factors from each of the day-of-week periods to produce the hourly VMT allocation factors for Weekday, Friday, Saturday, and Sunday, as summarized in the tables in Appendix C. These hourly volume fractions were applied to the adjusted four-period, time-of-day link VMT and intrazonal VMT by functional group and area type to allocate the VMT to each hour of the day.

ESTIMATION OF LINK SPEEDS

The operational speeds by direction and time-of-day period were calculated on each freeway, arterial, and collector link using the Houston speed model that uses a “speed reduction factor” approach in calculating the link-speeds. For locals streets (which include centroid connector and intrazonal functional classifications), no speed model was used to estimate speeds. These methods are documented in the TTI Research Report “Texas Mobile Source Emissions Software User’s Guide: MOBILE6,” May 2003.

The Houston speed model calculates the operational link speeds by direction and time period as a function of the link’s estimated freeflow speed, estimated Level of Service (LOS) E speed, and v/c ratio-based speed reduction factors (SRF). The SRFs describe the decay from a freeflow speed (i.e., the uncongested speed for a v/c ratio approaching 0.0) to an LOS E speed (i.e., the congested speed for a v/c ratio of 1.0). The values of the SRFs vary from 0.0 to 1.0.

To assist in calculating capacity factors and speed factors required to estimate the operational link speeds, the network functional classifications were regrouped into the five functional groups as shown in Table 6.

The VMT summaries by the eight-county area, county, day hour, road type, and vehicle type are included with the emissions inventory data provided to TCEQ on CD-ROM. Appendix A lists the electronic data files with descriptions.

Table 6
Functional Classification to Functional Group Table of Equals
for Application of Capacity and Speed Factors

Functional Group	Corresponding Network Functional Classifications
Freeways, Interstates	1. Urban Interstate Freeways 2. Urban Other Freeways 10. Rural Interstate Freeways 11. Rural Other Freeways
Principal Arterials	5. Urban Principal Arterials 12. Rural Principal Arterials
Other Arterials, Major Collectors	6. Urban Other Arterials 13. Rural Other Arterials 14. Rural Major Collectors
Collectors	7. Urban Collectors 15. Rural Collectors
Locals	8. Locals (Centroid Connectors) 16. Locals (Intrazonals)

The v/c ratios by time period were required for each link. Directional time period link volumes were calculated by multiplying the associated directional link VMT¹ by the time period volume factor divided by the link distance. The directional time-period link capacities were calculated by multiplying the time period directional link capacity by the time period capacity factor. The capacity factors for each time period (shown in Appendix D) are the same for each area type and functional class. The time period link v/c ratios were then calculated by dividing the directional link volume by the directional link capacity.

To estimate the link freeflow and LOS E speeds, the link equilibrium assignment speeds, indexed by functional group and area type, were multiplied by a pair of speed factors corresponding to each functional group and area type. These speed factors (shown in Appendix D) were developed by dividing the distance-weighted average equilibrium assignment input speeds into the average modeled freeflow speeds (v/c = 0.0), and the average modeled LOS E speeds (v/c = 1.0). These factors were produced on a functional group and area type basis. The estimated link freeflow and LOS E speeds were assumed the same in each direction.

¹ From one of the four time-of-day directional assignments used.

The speed model (for v/c ratios from 0.00 to 1.00) is expressed as:

$$S_{v/c} = S_{0.0} - \text{SRF}_{v/c} \times (S_{0.0} - S_{1.0})$$

Where:

$S_{v/c}$ = estimated directional speed for the forecast v/c ratio on the link in the subject direction;

$S_{0.0}$ = estimated freeflow speed for v/c ratio equal to 0.0;

$S_{1.0}$ = estimated LOS E speed for v/c ratio equal to 1.0; and

$\text{SRF}_{v/c}$ = speed reduction factor for the v/c ratio on the link. The v/c ratio can be 0.0 to 1.0. (For v/c ratios greater than 1.0, the model extension discussed below is used.)

The speed extension model used for v/c > 1.0 is:

$$S_{v/c} = S_{1.0} \times (1.15 / (1.0 + (0.15 \times (v/c)^4)))$$

Where:

$S_{v/c}$ = estimated directional speed for the forecast v/c ratio on the link in the subject direction;

$S_{1.0}$ = estimated LOS E speed for the v/c ratio equal to 1.0; and

v/c = the forecast v/c ratio on the link. The v/c ratio can be 1.0 to 1.5. For v/c ratios greater than 1.5, the speed is computed for the v/c ratio of 1.5.

These models were applied, dependent on the link v/c ratio, to estimate the speeds at the link level for freeways, arterials, and collectors. The speed reduction factors by v/c ratio for each functional group (except local streets) are presented as four figures in Appendix D.

Capacity data are not used, however, for the centroid connector and intrazonal functional classifications that make up the locals road type. The centroid connector traffic assignment input speeds were thus used as the centroid connector operational speeds estimates. Operational speeds for the intrazonal trips category were estimated by zone as the average of the zone's centroid connector speeds.

The hourly and 24-hour VMT weighted speed summaries by county and road type were provided electronically to TCEQ (see Appendix A for electronic data descriptions).

ESTIMATION OF VMT MIX

For the 2000 estimate, 1997 - 2000 TxDOT vehicle classification data were used. The eight-county area data were aggregated.

TxDOT classification counts classify vehicles into the standard FHWA vehicle classifications (based on vehicle length/number of axles) using best practice vehicle classification count methods:

C	Passenger vehicles;
P	Two-axle, four-tire single-unit trucks;
B	Buses;
SU2	Six-tire, two-axle single-unit vehicles;
SU3	Three-axle single-unit vehicles;
SU4	Four or more axle single-unit vehicles;
SE4	Three or four axle single-trailer vehicles;
SE5	Five-axle single-trailer vehicles;
SE6	Six or more axle single-trailer vehicles;
SD5	Five or less axle multi-trailer vehicles;
SD6	Six-axle multi-trailer vehicles; and
SD7	Seven or more axle multi-trailer vehicles.

EPA and MOBILE use a different vehicle classification scheme than the FHWA categories. The 28 EPA vehicle categories are defined as a function of gross vehicle weight rating (GVWR) and fuel type (see Table 7). The FHWA axle/vehicle length-based classification categories must be converted into 28 MOBILE GVWR/fuel type based categories.

The FHWA vehicle classification counts are first aggregated into three intermediate groups:

Passenger Vehicles (PV)	$C + P$;
Heavy-Duty Vehicles (HDV)	$SU2 + SU3 + SU4 + SE4$; and
HDDV8b (HDX)	$SE5 + SE6 + SD5 + SD6 + SD7$.

This is followed by a second intermediate allocation that separates light-duty vehicles (LDV) into PVs and light-duty trucks (LDT) based on TxDOT registration data:

LDV	$0.695 \times PV$ (by county, 2002 Harris registration data shown); and
LDT	$0.305 \times PV$ (by county, 2002 Harris registration data shown).

A third intermediate allocation further separates LDTs into LDT1 and HLDT (note that LDT1 is itself intermediate and is further divided into LDGT1 and LDDT.):

LDT1	$0.813 \times LDT$ (by county, 2002 Harris registration data shown); and
HLDT	$0.187 \times LDT$ (by county, 2002 Harris registration data shown).

Next, the remaining FHWA categories are disaggregated into EPA vehicle groups, as shown. Note that TxDOT vehicle classification count procedures do not distinguish between gasoline and diesel LDTs. Consequently, MOBILE defaults for the year of interest are used. As before, actual TxDOT vehicle registration data are used to separate gasoline from diesel heavy-duty trucks. Note also that motorcycles are not counted separately and are included as a default (subtracted from LDGV):

LDGV	$0.9989987 \times \text{LDV}$ (MOBILE6 default for 2007 shown);
LDDV	$0.0010013 \times \text{LDV}$ (MOBILE6 default for 2007 shown);
LLDT	$0.9947975 \times \text{LDT1}$ (MOBILE6 default for 2007 shown);
LDDT	$0.0052025 \times \text{LDT1}$ (MOBILE6 default for 2007 shown);
HDGV	$0.358 \times \text{HDV}$ (by county, 2002 Harris County registration data shown);
HDDV	$0.642 \times \text{HDV}$ (by county, 2002 Harris County registration data shown); and
MC	0.001 of total (subtracted from LDGV).

This converts the FHWA axle count-based categories into GVWR categories. This part of the conversion procedure is summarized schematically in Table 8. Starting with the TxDOT vehicle classification data, these data themselves provide sufficient information to complete the first step in the conversion process, the allocation of vehicles into PVs, HDVs, HDDV8bs, and buses (B). Steps 2 and 3 further allocate these categories using TxDOT registration data. Finally, Step 4 allocates light-duty vehicles by fuel type using EPA MOBILE diesel fractions and motorcycles are separated from light-duty gasoline vehicles using a nominal constant.

The MOBILE6 28-category typology is a subset of this typology. A combination of EPA MOBILE6 defaults and area vehicle registration data are used to expand these intermediate categories.

For the 28-category EPA scheme, HDVs — HDGV and HDDV — are separated into eight and seven categories respectively. HDDV8b vehicles are counted directly. The 15 HDV categories are separated from total HDV, which have been separated by fuel type using TxDOT registration data by county. Each HDV category (HDGV and HDDV) is then divided into subcategories based on TxDOT area vehicle registration data. Buses are treated separately.

The 28-category EPA scheme also further divides the two LDT categories based in part on assumed loading. The previous LDGT1 and LDGT2 categories (previously defined as $\text{GVWR} \leq 6,000$ and $\text{GVWR} > 6,000$ to 8,500, respectively) are separated into subcategories in terms of adjusted loaded vehicle weight (ALVW). ALVW is the average of vehicle curb weight and GVWR. Thus, two new intermediate categories are introduced. These are light light-duty trucks (LLDT) and heavy light-duty trucks (HLDT), which are defined as:

- LLDT - any light-duty truck rated through 6,000 pounds GVWR, and
- HLDT - any light-duty truck rated greater than 6,000 pounds GVWR.

These two new intermediate categories are then used to define the four LDT categories using EPA MOBILE6 defaults for the year of interest. The four LDT categories are:

- LDGT1 - light light-duty trucks through 3,750 pounds loaded vehicle weight (LVW);
- LDGT2 - light light-duty trucks greater than 3,750 pounds LVW;
- LDGT3 - heavy light-duty trucks to 5,750 pounds ALVW; and
- LDGT4 - heavy light-duty trucks greater than 5,750 pounds ALVW.

Similarly, the LDDT category is sub-divided into two categories based on GVWR (less than or equal to 6,000 GVWR and 6,000 to 8,500 GVWR). This is accomplished using EPA MOBILE6 default values for the year of interest.

Finally the three bus categories are separated from the TxDOT classification counts bus category using EPA MOBILE6 default values. (Under MOBILE6 the HDV category does not include buses.)

For historical VMT mix estimates, the MOBILE6 default values consistent with the historical year are used. No other adjustments are made to alter the count data and conversion procedure to accommodate historical years. Table 9 shows the VMT mix estimation procedure summary followed by explanatory notes. For this analysis, VMT mix estimates were developed for application with three functional classification groups (see Table 31 in Emissions Calculations section) and four time-of-day periods (See Table 5).

This procedure is performed as described for weekdays. TxDOT vehicle classification data are only collected for weekdays (Monday through Thursday), consequently other data is used to estimate VMT mix for Fridays, Saturdays, and Sundays. The procedure used to estimate Friday, Saturday, and Sunday VMT mix relies on vehicle classification data collected over several years in urban areas. The ratio of weekday VMT mix to Friday, Saturday, and Sunday VMT mix is applied to the weekday VMT mix to produce region specific Friday, Saturday and Sunday VMT mix. (No seasonal changes are assumed.)

Table 7
EPA Vehicle Types - 28 Categories

Category	Description	GVWR
LDGV	Light-duty gasoline vehicle	$\leq 6,000$
LDGT1	Light-duty gasoline truck	$\leq 6,000$
LDGT2	Light-duty gasoline truck	$\leq 6,000$
LDGT3	Light-duty gasoline truck	6,001 - 8,500
LDGT4	Light-duty gasoline truck	6,001 - 8,500
HDGV2b	Heavy-duty gasoline vehicle	8,501 - 10,000
HDGV3	Heavy-duty gasoline vehicle	10,001 - 14,000
HDGV4	Heavy-duty gasoline vehicle	14,001 - 16,000
HDGV5	Heavy-duty gasoline vehicle	16,001 - 19,500
HDGV6	Heavy-duty gasoline vehicle	19,501 - 26,000
HDGV7	Heavy-duty gasoline vehicle	26,001 - 33,000
HDGV8a	Heavy-duty gasoline vehicle	33,001 - 60,000
HDGV8b	Heavy-duty gasoline vehicle	$> 60,000$
HDGB	Heavy-duty gasoline bus	all
LDDV	Light-duty diesel vehicle	$\leq 6,000$
LDDT12	Light-duty diesel truck	$\leq 6,000$
LDDT34	Light-duty diesel truck	6,001 - 8,500
HDDV2b	Heavy-duty diesel vehicle	8,501 - 10,000
HDDV3	Heavy-duty diesel vehicle	10,001 - 14,000
HDDV4	Heavy-duty diesel vehicle	14,001 - 16,000
HDDV5	Heavy-duty diesel vehicle	16,001 - 19,500
HDDV6	Heavy-duty diesel vehicle	19,501 - 26,000
HDDV7	Heavy-duty diesel vehicle	26,001 - 33,000
HDDV8a	Heavy-duty diesel vehicle	33,001 - 60,000
HDDV8b	Heavy-duty diesel vehicle	$> 60,000$
HDDBS	Heavy-duty diesel school bus	all
HDDBT	Heavy-duty diesel transit bus	all
MC	Motorcycle	all

Table 8
Initial Vehicle Classification Conversion Procedure

Start	Step 1	Step 2	Step 3	Step 4
Total Vehicles	PV	LDV	LDGV	MC
				LDGV
			LDDV	
		LDT	LDT1	LLDT
				LDDT
			HLDT	
	HDV	HDGV		
		HDDV		
	HDDV8b			
	B			

Table 9
VMT Mix Estimation Procedure Summary

EPA-8	EPA-28	Conversion
LDGV	LDGV	$.9990 \times \text{LDV}$
LDGT1	LDGT1	$.2310 \times \text{LLDT}$
	LDGT2	$.7690 \times \text{LLDT}$
LDGT2	LDGT3	$.6850 \times \text{HLDT}$
	LDGT4	$.3150 \times \text{HLDT}$
HDGV	HDGV2b	$.519 \times \text{HDGV}$
	HDGV3	$.194 \times \text{HDGV}$
	HDGV4	$.094 \times \text{HDGV}$
	HDGV5	$.034 \times \text{HDGV}$
	HDGV6	$.091 \times \text{HDGV}$
	HDGV7	$.032 \times \text{HDGV}$
	HDGV8a	$.032 \times \text{HDGV}$
	HDGV8b	$.004 \times \text{HDGV}$
	HDGB	$.0931 \times \text{B}$
LDDV	LDDV	$.0010 \times \text{LDV}$
LDDT	LDDT12	$.0337 \times \text{LDDT}$
	LDDT34	$.9663 \times \text{LDDT}$
HDDV	HDDV2b	$.278 \times \text{HDDV}$
	HDDV3	$.134 \times \text{HDDV}$
	HDDV4	$.081 \times \text{HDDV}$
	HDDV5	$.053 \times \text{HDDV}$
	HDDV6	$.168 \times \text{HDDV}$
	HDDV7	$.102 \times \text{HDDV}$
	HDDV8a	$.184 \times \text{HDDV}$
	HDDV8b	HDX
	HDDBT	$.3239 \times \text{B}$
	HDDBS	$.5830 \times \text{B}$
MC	MC	MC

Notes to VMT Mix Estimation Procedure Summary

Intermediate category factors and sources:

LDV	$.695 \times \text{PV}$ (by county, 2002 Harris County registration data shown)
LDT	$.305 \times \text{PV}$ (by county, 2002 Harris County registration data shown)
LDT1	$.813 \times \text{LDT}$ (by county, 2002 Harris County registration data shown)
HLDT	$.187 \times \text{LDT}$ (by county, 2002 Harris County registration data shown)
LLDT	$.9948 \times \text{LDT1}$ (EPA MOBILE6 default, 2007 shown)
LDDT	$.0052 \times \text{LDT1}$ (EPA MOBILE6 default, 2007 shown)
HDV	SU2+SU3+SU4+SE3+SE4
HDX	SE5+SE6+SD5+SD6+SD7
HDGV	$.358 \times \text{HDV}$ (by county, 2002 Harris County registration data shown)
HDDV	$.642 \times \text{HDV}$ (by county, 2002 Harris County registration data shown)

Category conversion factors and sources:

LDGV	$.9990 \times \text{LDV}$ (EPA MOBILE6 default, 2007 shown)
LDGT1	$.2310 \times \text{LLDT}$ (EPA MOBILE6 default, 2007 shown)
LDGT2	$.7690 \times \text{LLDT}$ (EPA MOBILE6 default, 2007 shown)
LDGT3	$.6850 \times \text{HLDT}$ (EPA MOBILE6 default, 2007 shown)
LDGT4	$.3150 \times \text{HLDT}$ (EPA MOBILE6 default, 2007 shown)
HDGV2a	$.519 \times \text{HDGV}$ (HGAC area registration data)
HDGV3	$.194 \times \text{HDGV}$ (HGAC area registration data)
HDGV4	$.094 \times \text{HDGV}$ (HGAC area registration data)
HDGV5	$.034 \times \text{HDGV}$ (HGAC area registration data)
HDGV6	$.091 \times \text{HDGV}$ (HGAC area registration data)
HDGV7	$.032 \times \text{HDGV}$ (HGAC area registration data)
HDGV8a	$.032 \times \text{HDGV}$ (HGAC area registration data)
HDGV8b	$.004 \times \text{HDGV}$ (HGAC area registration data)
HDGB	$.0931 \times \text{B}$ (EPA MOBILE6 default, 2007 shown)
LDDV	$.0010 \times \text{LDV}$ (EPA MOBILE6 default, 2007 shown)
LDDT12	$.0337 \times \text{LDDT}$ (EPA MOBILE6 default, 2007 shown)
LDDT34	$.9663 \times \text{LDDT}$ (EPA MOBILE6 default, 2007 shown)
HDDV2b	$.278 \times \text{HDDV}$ (HGAC area registration data)
HDDV3	$.134 \times \text{HDDV}$ (HGAC area registration data)
HDDV4	$.081 \times \text{HDDV}$ (HGAC area registration data)
HDDV5	$.053 \times \text{HDDV}$ (HGAC area registration data)
HDDV6	$.168 \times \text{HDDV}$ (HGAC area registration data)
HDDV7	$.102 \times \text{HDDV}$ (HGAC area registration data)
HDDV8a	$.184 \times \text{HDDV}$ (HGAC area registration data)
HDDV8b	HDX (TxDOT classification counts)
HDDBT	$.3239 \times \text{B}$ (EPA MOBILE6 default, 2007 shown)
HDDBS	$.5830 \times \text{B}$ (EPA MOBILE6 default, 2007 shown)
MC	MC (default subtracted from LDGV, no conversion)

Table 10
HGA Weekday VMT Mix by Time Period and Roadway Functional Classification Group

OBS	TP	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	AM_Peak	Art	0.6276763	0.0573346	0.1908653	0.0344063	0.0158222	0.0072693	0.0027348	0.0012611	0.0005385
2	AM_Peak	Col	0.5411781	0.0688742	0.2292803	0.0459848	0.0211467	0.0109288	0.0041116	0.0018960	0.0008095
3	AM_Peak	Fway	0.6539035	0.0531817	0.1770403	0.0305747	0.0140602	0.0067509	0.0025398	0.0011712	0.0005001
4	Mid_Day	Art	0.5899229	0.0539002	0.1794324	0.0322804	0.0148446	0.0132972	0.0050026	0.0023069	0.0009850
5	Mid_Day	Col	0.5098221	0.0645629	0.2149282	0.0431115	0.0198254	0.0198183	0.0074560	0.0034383	0.0014680
6	Mid_Day	Fway	0.6195840	0.0505174	0.1681711	0.0291083	0.0133858	0.0112382	0.0042280	0.0019497	0.0008325
7	Ovr_Nite	Art	0.6258909	0.0573916	0.1910550	0.0343741	0.0158074	0.0054099	0.0020353	0.0009386	0.0004007
8	Ovr_Nite	Col	0.5576924	0.0709778	0.2362830	0.0473891	0.0217925	0.0079336	0.0029848	0.0013764	0.0005877
9	Ovr_Nite	Fway	0.6388346	0.0519594	0.1729713	0.0299059	0.0137526	0.0052614	0.0019794	0.0009128	0.0003897
10	PM_Peak	Art	0.6270796	0.0576340	0.1918620	0.0345923	0.0159077	0.0078820	0.0029654	0.0013674	0.0005839
11	PM_Peak	Col	0.5422065	0.0689709	0.2296021	0.0460498	0.0211766	0.0125232	0.0047115	0.0021726	0.0009276
12	PM_Peak	Fway	0.6533583	0.0534162	0.1778210	0.0308405	0.0141824	0.0066212	0.0024910	0.0011487	0.0004905
OBS	P_HDGV_6	P_HDGV_7	P_HDGV8A	P_HDGV8B	P_LDDV	P_LDDT12	P_HDDV2B	P_HDDV_3	P_HDDV_4	P_HDDV_5	
1	0.0013037	0.0005243	0.0004818	0.0000567	0.0014380	0.0002264	0.0068511	0.0035677	0.0020941	0.0013444	
2	0.0019599	0.0007882	0.0007243	0.0000852	0.0012401	0.0002720	0.0097849	0.0050955	0.0029908	0.0019201	
3	0.0012107	0.0004869	0.0004474	0.0000526	0.0014980	0.0002100	0.0060802	0.0031663	0.0018585	0.0011931	
4	0.0023847	0.0009591	0.0008813	0.0001037	0.0013516	0.0002129	0.0124536	0.0064853	0.0038066	0.0024437	
5	0.0035542	0.0014294	0.0013135	0.0001545	0.0011684	0.0002550	0.0179217	0.0093328	0.0054780	0.0035167	
6	0.0020154	0.0008106	0.0007448	0.0000876	0.0014195	0.0001995	0.0100972	0.0052582	0.0030863	0.0019813	
7	0.0009702	0.0003902	0.0003586	0.0000422	0.0014339	0.0002267	0.0051468	0.0026802	0.0015732	0.0010099	
8	0.0014228	0.0005722	0.0005258	0.0000619	0.0012779	0.0002803	0.0071693	0.0037335	0.0021914	0.0014068	
9	0.0009436	0.0003795	0.0003487	0.0000410	0.0014635	0.0002052	0.0047484	0.0024727	0.0014514	0.0009318	
10	0.0014135	0.0005685	0.0005224	0.0000615	0.0014366	0.0002276	0.0074190	0.0038635	0.0022677	0.0014558	
11	0.0022459	0.0009032	0.0008300	0.0000976	0.0012425	0.0002724	0.0113440	0.0059074	0.0034674	0.0022260	
12	0.0011874	0.0004776	0.0004388	0.0000516	0.0014967	0.0002110	0.0059594	0.0031034	0.0018216	0.0011694	
OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34		
1	0.0043175	0.0028438	0.0048345	0.0257443	0.0010000	0.0008782	0.0013973	0.0020195	0.0011684		
2	0.0061663	0.0040616	0.0069048	0.0249789	0.0010000	0.0013114	0.0020864	0.0030156	0.0014035		
3	0.0038317	0.0025239	0.0042906	0.0273155	0.0010000	0.0008238	0.0013106	0.0018943	0.0010837		
4	0.0078481	0.0051694	0.0087880	0.0509593	0.0010000	0.0004258	0.0006774	0.0009791	0.0010984		
5	0.0112941	0.0074392	0.0126466	0.0355717	0.0010000	0.0004453	0.0007085	0.0010240	0.0013157		
6	0.0063631	0.0041913	0.0071252	0.0532114	0.0010000	0.0004834	0.0007691	0.0011117	0.0010294		
7	0.0032435	0.0021364	0.0036319	0.0401413	0.0010000	0.0003153	0.0005017	0.0007251	0.0011695		
8	0.0045180	0.0029759	0.0050591	0.0174233	0.0010000	0.0003922	0.0006240	0.0009019	0.0014464		
9	0.0029924	0.0019710	0.0033507	0.0580966	0.0010000	0.0005270	0.0008385	0.0012119	0.0010588		
10	0.0046754	0.0030796	0.0052353	0.0228026	0.0010000	0.0005975	0.0009507	0.0013741	0.0011745		
11	0.0071488	0.0047088	0.0080050	0.0147100	0.0010000	0.0012565	0.0019990	0.0028892	0.0014055		
12	0.0037556	0.0024737	0.0042053	0.0280924	0.0010000	0.0006334	0.0010077	0.0014565	0.0010885		

Table 11
HGA Friday VMT Mix by Time Period and Roadway Functional Classification Group

OBS	TP	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	AM_Peak	Art	0.6762858	0.0526794	0.1753682	0.0318670	0.0146544	0.0041429	0.0015586	0.0007188	0.0003069
2	AM_Peak	Col	0.5945738	0.0645252	0.2148026	0.0434275	0.0199707	0.0063510	0.0023894	0.0011018	0.0004704
3	AM_Peak	Fway	0.7011107	0.0486261	0.1618749	0.0281804	0.0129591	0.0038288	0.0014405	0.0006643	0.0002836
4	Mid_Day	Art	0.6493717	0.0505942	0.1684267	0.0305441	0.0140461	0.0077422	0.0029127	0.0013432	0.0005735
5	Mid_Day	Col	0.5719750	0.0617630	0.2056072	0.0415735	0.0191181	0.0117599	0.0044243	0.0020402	0.0008711
6	Mid_Day	Fway	0.6767078	0.0470503	0.1566290	0.0273285	0.0125674	0.0064925	0.0024426	0.0011264	0.0004809
7	Ovr_Nite	Art	0.6745465	0.0527461	0.1755904	0.0318458	0.0146447	0.0030841	0.0011603	0.0005351	0.0002284
8	Ovr_Nite	Col	0.6063560	0.0658070	0.2190697	0.0442901	0.0203674	0.0045626	0.0017165	0.0007916	0.0003380
9	Ovr_Nite	Fway	0.6900852	0.0478638	0.1593371	0.0277701	0.0127705	0.0030063	0.0011310	0.0005216	0.0002227
10	PM_Peak	Art	0.6756004	0.0529512	0.1762730	0.0320372	0.0147327	0.0044919	0.0016899	0.0007793	0.0003327
11	PM_Peak	Col	0.5955495	0.0645991	0.2150485	0.0434777	0.0199938	0.0072756	0.0027372	0.0012622	0.0005389
12	PM_Peak	Fway	0.7004032	0.0488319	0.1625602	0.0284205	0.0130695	0.0037546	0.0014125	0.0006514	0.0002781
OBS	P_HDGV_6	P_HDGV_7	P_HDGV8A	P_HDGV8B	P_LDDV	P_LDDT12	P_HDDV2B	P_HDDV_3	P_HDDV_4	P_HDDV_5	
1	0.0007430	0.0002988	0.0002746	0.0000323	0.0015446	0.0002084	0.0045754	0.0023827	0.0013985	0.0008978	
2	0.0011390	0.0004581	0.0004209	0.0000495	0.0013582	0.0002552	0.0066631	0.0034698	0.0020366	0.0013075	
3	0.0006866	0.0002762	0.0002538	0.0000299	0.0016012	0.0001923	0.0040408	0.0021043	0.0012351	0.0007929	
4	0.0013885	0.0005584	0.0005131	0.0000604	0.0014832	0.0002001	0.0084967	0.0044247	0.0025971	0.0016673	
5	0.0021090	0.0008482	0.0007794	0.0000917	0.0013067	0.0002443	0.0124616	0.0064894	0.0038090	0.0024453	
6	0.0011643	0.0004683	0.0004303	0.0000506	0.0015456	0.0001861	0.0068355	0.0035596	0.0020893	0.0013413	
7	0.0005531	0.0002224	0.0002044	0.0000240	0.0015406	0.0002086	0.0034382	0.0017905	0.0010509	0.0006747	
8	0.0008182	0.0003291	0.0003024	0.0000356	0.0013851	0.0002603	0.0048314	0.0025160	0.0014768	0.0009481	
9	0.0005391	0.0002168	0.0001993	0.0000234	0.0015761	0.0001893	0.0031793	0.0016557	0.0009718	0.0006239	
10	0.0008056	0.0003240	0.0002977	0.0000350	0.0015430	0.0002095	0.0049544	0.0025800	0.0015144	0.0009722	
11	0.0013048	0.0005248	0.0004822	0.0000567	0.0013605	0.0002555	0.0077228	0.0040217	0.0023605	0.0015154	
12	0.0006733	0.0002708	0.0002488	0.0000293	0.0015996	0.0001932	0.0039599	0.0020621	0.0012104	0.0007770	
OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34		
1	0.0028834	0.0018992	0.0032287	0.0171930	0.0010000	0.0005005	0.0009331	0.0013487	0.0010752		
2	0.0041990	0.0027658	0.0047019	0.0170096	0.0010000	0.0007621	0.0014208	0.0020535	0.0013170		
3	0.0025465	0.0016773	0.0028515	0.0181536	0.0010000	0.0004672	0.0008710	0.0012589	0.0009925		
4	0.0053545	0.0035269	0.0059958	0.0347681	0.0010000	0.0002479	0.0004622	0.0006680	0.0010326		
5	0.0078531	0.0051727	0.0087936	0.0247341	0.0010000	0.0002643	0.0004926	0.0007120	0.0012606		
6	0.0043076	0.0028374	0.0048235	0.0360224	0.0010000	0.0002793	0.0005207	0.0007526	0.0009603		
7	0.0021667	0.0014272	0.0024262	0.0268152	0.0010000	0.0001798	0.0003351	0.0004844	0.0010766		
8	0.0030447	0.0020055	0.0034093	0.0117416	0.0010000	0.0002256	0.0004205	0.0006078	0.0013431		
9	0.0020036	0.0013197	0.0022435	0.0388992	0.0010000	0.0003011	0.0005614	0.0008115	0.0009769		
10	0.0031222	0.0020565	0.0034961	0.0152275	0.0010000	0.0003405	0.0006349	0.0009176	0.0010807		
11	0.0048668	0.0032057	0.0054496	0.0100143	0.0010000	0.0007300	0.0013609	0.0019669	0.0013185		
12	0.0024955	0.0016437	0.0027943	0.0186667	0.0010000	0.0003592	0.0006696	0.0009678	0.0009967		

Table 12
HGA Saturday VMT Mix by Time Period and Roadway Functional Classification Group

OBS	TP	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	AM_Peak	Art	0.7003766	0.0518066	0.1724629	0.0294286	0.0135331	0.0026086	0.0009814	0.0004526	0.0001932
2	AM_Peak	Col	0.6220148	0.0640999	0.2133869	0.0405114	0.0186297	0.0040395	0.0015197	0.0007008	0.0002992
3	AM_Peak	Fway	0.7244332	0.0477119	0.1588315	0.0259650	0.0119404	0.0024054	0.0009049	0.0004173	0.0001782
4	Mid_Day	Art	0.6825745	0.0504999	0.1681127	0.0286287	0.0131653	0.0049478	0.0018615	0.0008584	0.0003665
5	Mid_Day	Col	0.6071253	0.0622517	0.2072341	0.0393480	0.0180947	0.0075891	0.0028552	0.0013166	0.0005622
6	Mid_Day	Fway	0.7082219	0.0467592	0.1556601	0.0255038	0.0117282	0.0041312	0.0015542	0.0007167	0.0003060
7	Ovr_Nite	Art	0.6990054	0.0519042	0.1727875	0.0294271	0.0135324	0.0019431	0.0007310	0.0003371	0.0001439
8	Ovr_Nite	Col	0.6297914	0.0649053	0.2160678	0.0410203	0.0188637	0.0028813	0.0010840	0.0004999	0.0002134
9	Ovr_Nite	Fway	0.7172239	0.0472390	0.1572573	0.0257369	0.0118354	0.0018997	0.0007147	0.0003296	0.0001407
10	PM_Peak	Art	0.6995178	0.0520628	0.1733158	0.0295795	0.0136025	0.0028278	0.0010639	0.0004906	0.0002095
11	PM_Peak	Col	0.6226999	0.0641388	0.2135163	0.0405364	0.0186412	0.0046251	0.0017401	0.0008024	0.0003426
12	PM_Peak	Fway	0.7236067	0.0479076	0.1594829	0.0261828	0.0120405	0.0023584	0.0008873	0.0004092	0.0001747
OBS	P_HDGV_6	P_HDGV_7	P_HDGV8A	P_HDGV8B	P_LDDV	P_LDDT12	P_HDDV2B	P_HDDV_3	P_HDDV_4	P_HDDV_5	
1	0.0004678	0.0001881	0.0001729	0.0000203	0.0016013	0.0002043	0.0028807	0.0015001	0.0008805	0.0005653	
2	0.0007244	0.0002913	0.0002677	0.0000315	0.0014224	0.0002528	0.0042376	0.0022068	0.0012953	0.0008315	
3	0.0004314	0.0001735	0.0001594	0.0000188	0.0016563	0.0001882	0.0025383	0.0013219	0.0007759	0.0004981	
4	0.0008873	0.0003569	0.0003279	0.0000386	0.0015607	0.0001992	0.0054295	0.0028274	0.0016596	0.0010654	
5	0.0013610	0.0005474	0.0005030	0.0000592	0.0013884	0.0002455	0.0080411	0.0041874	0.0024578	0.0015779	
6	0.0007409	0.0002980	0.0002738	0.0000322	0.0016193	0.0001844	0.0043490	0.0022648	0.0013293	0.0008534	
7	0.0003485	0.0001401	0.0001288	0.0000152	0.0015982	0.0002047	0.0021660	0.0011280	0.0006621	0.0004250	
8	0.0005167	0.0002078	0.0001910	0.0000225	0.0014402	0.0002560	0.0030507	0.0015887	0.0009325	0.0005986	
9	0.0003407	0.0001370	0.0001259	0.0000148	0.0016398	0.0001863	0.0020089	0.0010461	0.0006140	0.0003942	
10	0.0005071	0.0002040	0.0001874	0.0000220	0.0015994	0.0002054	0.0031186	0.0016240	0.0009532	0.0006120	
11	0.0008295	0.0003336	0.0003065	0.0000361	0.0014240	0.0002530	0.0049089	0.0025563	0.0015005	0.0009633	
12	0.0004230	0.0001701	0.0001563	0.0000184	0.0016544	0.0001890	0.0024872	0.0012952	0.0007602	0.0004880	
OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34		
1	0.0018154	0.0011957	0.0020328	0.0108247	0.0010000	0.0003152	0.0005875	0.0008492	0.0010544		
2	0.0026705	0.0017590	0.0029903	0.0108178	0.0010000	0.0004847	0.0009036	0.0013060	0.0013046		
3	0.0015996	0.0010536	0.0017912	0.0114035	0.0010000	0.0002935	0.0005472	0.0007908	0.0009710		
4	0.0034216	0.0022538	0.0038314	0.0222172	0.0010000	0.0001584	0.0002953	0.0004269	0.0010278		
5	0.0050674	0.0033378	0.0056743	0.0159602	0.0010000	0.0001705	0.0003179	0.0004595	0.0012669		
6	0.0027407	0.0018053	0.0030689	0.0229191	0.0010000	0.0001777	0.0003313	0.0004788	0.0009516		
7	0.0013650	0.0008991	0.0015285	0.0168932	0.0010000	0.0001133	0.0002111	0.0003051	0.0010564		
8	0.0019225	0.0012663	0.0021528	0.0074140	0.0010000	0.0001424	0.0002655	0.0003838	0.0013210		
9	0.0012660	0.0008339	0.0014176	0.0245784	0.0010000	0.0001903	0.0003547	0.0005127	0.0009614		
10	0.0019653	0.0012945	0.0022007	0.0095852	0.0010000	0.0002144	0.0003996	0.0005776	0.0010596		
11	0.0030935	0.0020377	0.0034640	0.0063655	0.0010000	0.0004640	0.0008650	0.0012503	0.0013054		
12	0.0015674	0.0010324	0.0017551	0.0117243	0.0010000	0.0002256	0.0004206	0.0006079	0.0009750		

Table 13
HGA Sunday VMT Mix by Time Period and Roadway Functional Classification Group

OBS	TP	FC	P_LDGV	P_LDGT1	P_LDGT2	P_LDGT3	P_LDGT4	P_HDGV2B	P_HDGV_3	P_HDGV_4	P_HDGV_5
1	AM_Peak	Art	0.6604494	0.0617165	0.2054525	0.0336447	0.0154719	0.0017606	0.0006624	0.0003054	0.0001304
2	AM_Peak	Col	0.5783512	0.0752959	0.2506581	0.0456691	0.0210015	0.0026883	0.0010114	0.0004664	0.0001991
3	AM_Peak	Fway	0.6866480	0.0571302	0.1901848	0.0298373	0.0137211	0.0016317	0.0006139	0.0002831	0.0001209
4	Mid_Day	Art	0.6490353	0.0606613	0.2019398	0.0330030	0.0151769	0.0033672	0.0012668	0.0005842	0.0002494
5	Mid_Day	Col	0.5695410	0.0737760	0.2455983	0.0447526	0.0205801	0.0050954	0.0019170	0.0008840	0.0003774
6	Mid_Day	Fway	0.6759167	0.0563755	0.1876726	0.0295093	0.0135703	0.0028218	0.0010616	0.0004896	0.0002090
7	Ovr_Nite	Art	0.6592554	0.0618420	0.2058702	0.0336480	0.0154735	0.0013116	0.0004935	0.0002276	0.0000972
8	Ovr_Nite	Col	0.5831360	0.0759239	0.2527486	0.0460499	0.0211766	0.0019095	0.0007184	0.0003313	0.0001414
9	Ovr_Nite	Fway	0.6819809	0.0567440	0.1888991	0.0296692	0.0136438	0.0012928	0.0004864	0.0002243	0.0000958
10	PM_Peak	Art	0.6593435	0.0619939	0.2063760	0.0338020	0.0155443	0.0019076	0.0007177	0.0003310	0.0001413
11	PM_Peak	Col	0.5788234	0.0753202	0.2507388	0.0456843	0.0210085	0.0030771	0.0011577	0.0005338	0.0002279
12	PM_Peak	Fway	0.6856116	0.0573434	0.1908945	0.0300764	0.0138310	0.0015993	0.0006017	0.0002775	0.0001185
OBS	P_HDGV_6	P_HDGV_7	P_HDGV8A	P_HDGV8B	P_LDDV	P_LDDT12	P_HDDV2B	P_HDDV_3	P_HDDV_4	P_HDDV_5	
1	0.0003157	0.0001270	0.0001167	0.0000137	0.0015130	0.0002426	0.0019443	0.0010125	0.0005943	0.0003815	
2	0.0004821	0.0001939	0.0001782	0.0000210	0.0013252	0.0002960	0.0028203	0.0014687	0.0008621	0.0005534	
3	0.0002926	0.0001177	0.0001081	0.0000127	0.0015730	0.0002246	0.0017221	0.0008968	0.0005264	0.0003379	
4	0.0006039	0.0002429	0.0002232	0.0000263	0.0014869	0.0002384	0.0036952	0.0019243	0.0011295	0.0007251	
5	0.0009138	0.0003675	0.0003377	0.0000397	0.0013051	0.0002900	0.0053993	0.0028117	0.0016504	0.0010595	
6	0.0005061	0.0002035	0.0001870	0.0000220	0.0015484	0.0002216	0.0029708	0.0015471	0.0009081	0.0005830	
7	0.0002352	0.0000946	0.0000869	0.0000102	0.0015103	0.0002431	0.0014622	0.0007614	0.0004469	0.0002869	
8	0.0003424	0.0001377	0.0001266	0.0000149	0.0013362	0.0002984	0.0020219	0.0010529	0.0006180	0.0003968	
9	0.0002319	0.0000932	0.0000857	0.0000101	0.0015623	0.0002230	0.0013672	0.0007120	0.0004179	0.0002683	
10	0.0003421	0.0001376	0.0001264	0.0000149	0.0015105	0.0002437	0.0021040	0.0010957	0.0006431	0.0004129	
11	0.0005518	0.0002219	0.0002039	0.0000240	0.0013263	0.0002961	0.0032662	0.0017009	0.0009983	0.0006409	
12	0.0002868	0.0001153	0.0001060	0.0000125	0.0015706	0.0002254	0.0016867	0.0008784	0.0005156	0.0003310	
OBS	P_HDDV_6	P_HDDV_7	P_HDDV8A	P_HDDV8B	P_MC	P_HDGB	P_HDDBT	P_HDDBS	P_LDDT34		
1	0.0012253	0.0008071	0.0013720	0.0073062	0.0010000	0.0002127	0.0003965	0.0005731	0.0012517		
2	0.0017773	0.0011707	0.0019902	0.0071997	0.0010000	0.0003226	0.0006014	0.0008692	0.0015271		
3	0.0010852	0.0007148	0.0012152	0.0077364	0.0010000	0.0001991	0.0003712	0.0005365	0.0011587		
4	0.0023287	0.0015339	0.0026076	0.0151207	0.0010000	0.0001078	0.0002010	0.0002905	0.0012303		
5	0.0034026	0.0022412	0.0038101	0.0107168	0.0010000	0.0001145	0.0002135	0.0003085	0.0014963		
6	0.0018722	0.0012332	0.0020964	0.0156560	0.0010000	0.0001214	0.0002263	0.0003271	0.0011434		
7	0.0009215	0.0006069	0.0010318	0.0114039	0.0010000	0.0000764	0.0001425	0.0002060	0.0012542		
8	0.0012742	0.0008393	0.0014268	0.0049138	0.0010000	0.0000944	0.0001760	0.0002544	0.0015398		
9	0.0008616	0.0005675	0.0009648	0.0167276	0.0010000	0.0001295	0.0002414	0.0003489	0.0011508		
10	0.0013259	0.0008734	0.0014847	0.0064667	0.0010000	0.0001446	0.0002696	0.0003897	0.0012573		
11	0.0020583	0.0013558	0.0023048	0.0042353	0.0010000	0.0003087	0.0005755	0.0008319	0.0015276		
12	0.0010630	0.0007001	0.0011903	0.0079511	0.0010000	0.0001530	0.0002852	0.0004122	0.0011630		

ESTIMATION OF EMISSIONS FACTORS

The MOBILE6 model (October 2002) was applied for each county to calculate the episode day emissions factors (in grams per mile [g/mi]) of VOC, CO, and NO_x. Emissions factors are estimated by pollutant, speed, emissions type (i.e., emissions factor sub-component), hour, MOBILE6 road type (or drive cycle), and average vehicle class. The emissions factors are organized in the form of county-level, episode-day, parameter-indexed “look-up” tables. Emissions factor post-processing was required to properly model the Harris County Anti-Tampering Program (ATP).

The MOBILE6 model is equipped with national (or EPA) default modeling values for a wide range of conditions that affect emissions factors. In fact, the only actual data parameters requiring user-input values to run the model are fuel Reid Vapor Pressure (RVP), temperature, and calendar year. Many MOBILE6 default modeling parameters may be overridden through the use of MOBILE6 commands and their associated inputs and options. For this analysis, particular MOBILE6 defaults were replaced by local input values that were developed to yield emissions factors characteristic of the episode-day climatic conditions, and evaluation-specific vehicle fleets, activity, and emissions control programs.

The following emissions factors documentation discusses the MOBILE6 input/output files, summarizes the control programs modeled, details the aggregation-level of the applied MOBILE6 emissions factors, and briefly describes all of the MOBILE6 commands that may affect emissions factor calculations. It also identifies the commands that were applied, explains the development of the locality-specific inputs, and describes the emissions factor post-processing procedure.

MOBILE6 Input and Output Files

The MOBILE6 commands and particular model input data are entered in the MOBILE6 command file. Other input parameters (and in some cases, commands) are applied to MOBILE6 from external data files.

The POLFAC6 program (see program descriptions in Appendix B) was applied to run MOBILE6 with the user-input command and external data files to produce VOC, CO, and NO_x emissions factor output tables. (RATEADJ62 was applied to POLFAC6 output where post-processing of emissions factors was required to model the ATP, discussed later.) The final product of the emissions factor modeling is 160 emissions factor files (i.e., one table of hourly emissions factors for each county for each day). A corresponding set of average 24-hour emissions factors was also produced for quality assurance use.

All of the MOBILE6 input files and output files (MOBILE6 emissions factor tables developed with POLFAC6 and RATEADJ62) are provided on CD-ROM. The CD-ROM volume names and MOBILE6 input and output file names are listed in Appendix A.

Control Programs Modeled (And Emissions Factor Post Processing)

All of the federal motor vehicle control programs were modeled (this is the MOBILE6 default). Reformulated gasoline (RFG), the vehicle Inspections and Maintenance (I/M) programs and ATP administered during 2000 were modeled. Also modeled were the programs to offset heavy-duty diesel (HDDV) defeat device effects: the low emissions rebuild program, and the HDDV 2004 standard pull-ahead program. The only post-processing of emissions factors performed for this analysis was required to account for the full effects of the Harris County ATP. This post-processing procedure is detailed later with the description of the MOBILE6 ATP set-ups.

Aggregation Level of MOBILE6 Emissions Factors

The by-model-year (or age-specific) emissions factors from the MOBILE6 detailed database output are condensed into average fleet emissions factors by vehicle class. POLFAC62 performs this function for each vehicle type by weighting (multiplying) each of its age-specific emissions factors by their corresponding travel fractions (developed from the MOBILE6 database output age-specific REG_DIST and MILES parameter values) and summing the resulting products. Each emissions factor table provides the MOBILE6 emissions factors by:

- 28 vehicle types,
- 4 road types,
- 14 speeds (except for two MOBILE6 road types, each with one average speed),
- 15 pollutant-specific emissions types, and
- 24 hourly time periods.

MOBILE6 vehicle type, emissions type (pertaining to VOC, CO, and NO_x pollutants), and roadway type classifications are described in Tables 14 through 16. Tables 17 and 18 show the speeds and the sequence for hourly time periods, respectively.

The 28 MOBILE6 vehicle types as defined by fuel-type (gasoline or diesel) and GVWR category, are shown in sequence by EPA vehicle type number in Table 14.

Table 14
Complete MOBILE6 Vehicle Classifications

Number	Abbreviation	Description
1	LDGV	Light-Duty Gasoline Vehicles (Passenger Cars)
2	LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
3	LDGT2	Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
4	LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW*)
5	LDGT4	Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, 5,751 lbs. and greater ALVW)
6	HDGV2b	Class 2b Heavy-Duty Gasoline Vehicles (8,501-10,000 lbs. GVWR)
7	HDGV3	Class 3 Heavy-Duty Gasoline Vehicles (10,001-14,000 lbs. GVWR)
8	HDGV4	Class 4 Heavy-Duty Gasoline Vehicles (14,001-16,000 lbs. GVWR)
9	HDGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs. GVWR)
10	HDGV6	Class 6 Heavy-Duty Gasoline Vehicles (19,501-26,000 lbs. GVWR)
11	HDGV7	Class 7 Heavy-Duty Gasoline Vehicles (26,001-33,000 lbs. GVWR)
12	HDGV8a	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs. GVWR)
13	HDGV8b	Class 8b Heavy-Duty Gasoline Vehicles (>60,000 lbs. GVWR)
14	LDDV	Light-Duty Diesel Vehicles (Passenger Cars)
15	LDDT12	Light-Duty Diesel Trucks 1 and 2 (0-6,000 lbs. GVWR)
16	HDDV2b	Class 2b Heavy-Duty Diesel Vehicles (8,501-10,000 lbs. GVWR)
17	HDDV3	Class 3 Heavy-Duty Diesel Vehicles (10,001-14,000 lbs. GVWR)
18	HDDV4	Class 4 Heavy-Duty Diesel Vehicles (14,001-16,000 lbs. GVWR)
19	HDDV5	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs. GVWR)
20	HDDV6	Class 6 Heavy-Duty Diesel Vehicles (19,501-26,000 lbs. GVWR)
21	HDDV7	Class 7 Heavy-Duty Diesel Vehicles (26,001-33,000 lbs. GVWR)
22	HDDV8a	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs. GVWR)
23	HDDV8b	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs. GVWR)
24	MC	Motorcycles (Gasoline)
25	HDGB	Gasoline Buses (School, Transit, and Urban)
26	HDDBT	Diesel Transit and Urban Buses
27	HDDBS	Diesel School Buses
28	LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs. GVWR)

* The ALVW is the numerical average of the vehicle curb weight and the GVWR.

Source: MOBILE6 User's Guide (EPA, January 2002).

Table 15 shows the eight MOBILE6 emissions type classifications (excludes the non-pertinent pollutants, e.g., particulates and toxics). Expanding these emissions types by individual pollutant yields 12 pollutant-specific emissions types. In addition to these 12 pollutant-specific emissions types shown in Table 15, POLFAC62 emissions factor tables contain the three composite emissions factors (i.e., one for each pollutant). Thus, POLFAC62 calculates MOBILE6 emissions factors for up to 15 pollutant-specific emissions types. (For this analysis, MOBILE6 emissions factors were calculated for 14 pollutant-specific emissions types — the refueling emissions type is excluded since refueling emissions are classified as an area source emissions category.)

Table 15
MOBILE6 Emission Type Classifications

Number	Abbreviation	Description	Pollutants	Vehicle Classes
1	Running	Exhaust Running Emissions	Hydrocarbon (HC), CO, NO _x	All
2	Start	Exhaust Engine Start Emissions (trip start)	HC, CO, NO _x	All light-duty vehicles plus MC
3	Hot Soak	Evaporative Hot Soak Emissions (trip end)	HC	Gas, including MC
4	Diurnal	Evaporative Diurnal Emissions (heat rise)	HC	Gas, including MC
5	Resting	Evaporative Resting Loss Emissions (leaks and seepage)	HC	Gas, including MC
6	Run Loss	Evaporative Running Loss Emissions	HC	Gas, less MC
7	Crankcase	Evaporative Crankcase Emissions (blow-by)	HC	Gas, including MC
8	Refueling	Evaporative Refueling Emissions (fuel displacement and spillage)	HC	Gas, less MC

Source: MOBILE6 User's Guide (EPA, January 2002).

MOBILE6 calculates emissions factors reflective of driving cycles observed on four roadway types, as well as emissions factors for those emissions types that are not directly applicable to the driving cycles (e.g., start and the evaporative components excluding running losses). Table 16 shows the driving cycle (or roadway type) descriptions. The fifth roadway type, according to MOBILE6 is "None." None, or roadway type number 5, is the index for the emissions types that do not apply to the driving cycles, and thus are not sensitive to, or do not vary by, roadway type or speed.

The POLFAC62 emissions factor table, however, categorizes all of the pollutant-specific emissions types by MOBILE6 roadway types one through four — Freeway, Arterial, Local, and Ramp. That is, in POLFAC62 tables, the MOBILE6 g/mi emissions factors corresponding to the

“None” roadway type are tabulated as emissions factors under each of the four actual roadway types. This allocation of the MOBILE6 “None” road type emissions factors to the Freeway, Arterial, Local, and Ramp MOBILE6 road types is performed in POLFAC62 so that all emissions, regardless of “type,” may be spatially allocated to the functional class (or roadway type)-coded network links.

Table 16
MOBILE6 Roadway Classifications

Number	Abbreviation	Description
1	Freeway	High-speed, limited-access roadways
2	Arterial	Arterial and collector roadways
3	Local	Urban local roadways
4	Fwy Ramp	Freeway on and off ramps
5	None	Not applicable (for start and some evaporative emissions)

Source: MOBILE6 User’s Guide (EPA, January 2002).

Table 17 shows the 14 speeds for which the MOBILE6 freeway and arterial emissions factors are calculated and tabulated. Later in the emissions estimation process, emissions factors for average operational speeds that are not represented in the 14 speeds as tabulated, are calculated by interpolation (except for those speeds higher than the MOBILE6 maximum speed, and those lower than the MOBILE6 minimum speed, in which case the emissions factors corresponding to these bounding speeds are used, respectively). Also, during the emissions estimation process (discussed later) MOBILE6 Freeway and Ramp composite emissions factors are produced (using the EPA default percentages of 92 percent freeway and 8 percent ramp for application to combined freeway and ramp VMT) and applied to the HGA TDM network Freeway functional classification VMT, which includes ramp VMT (ramps are not separately coded in the network). The MOBILE6 Local and Ramp road type emissions factors are not speed sensitive and are each characterized by one average speed.

Table 17
Speeds for POLFAC62 Tabulated MOBILE6 Freeway and Arterial Emissions Factors*

Number	Speed
1	2.5 mph
2	5 mph
3	10 mph
4	15 mph
5	20 mph
6	25 mph
7	30 mph
8	35 mph
9	40 mph
10	45 mph
11	50 mph
12	55 mph
13	60 mph
14	65 mph

* The MOBILE6 Local and Ramp drive cycle emissions factor's fixed speeds are 12.9 and 34.6 mph, respectively.

MOBILE6 uses several hourly input parameters (e.g., hourly temperatures, hourly VMT fractions, etc.) to model hourly emissions factors. MOBILE6 requires that hourly input parameters be sequenced starting from the 6 a.m. hour. In some cases, however, particular overnight hours are grouped together as a single time period. Table 18 shows the MOBILE6 sequence for hourly inputs.

Table 18
General Sequence for Calendar Day Hourly* Inputs to MOBILE6

Input Sequence Number	Abbreviation	Description
1	6 a.m.	6 a.m. through 6:59 a.m.
2	7 a.m.	7 a.m. through 7:59 a.m.
3	8 a.m.	8 a.m. through 8:59 a.m.
4	9 a.m.	9 a.m. through 9:59 a.m.
5	10 a.m.	10 a.m. through 10:59 a.m.
6	11 a.m.	11 a.m. through 11:59 a.m.
7	12 Noon	12 p.m. through 12:59 p.m.
8	1 p.m.	1 p.m. through 1:59 p.m.
9	2 p.m.	2 p.m. through 2:59 p.m.
10	3 p.m.	3 p.m. through 3:59 p.m.
11	4 p.m.	4 p.m. through 4:59 p.m.
12	5 p.m.	5 p.m. through 5:59 p.m.
13	6 p.m.	6 p.m. through 6:59 p.m.
14	7 p.m.	7 p.m. through 7:59 p.m.
15	8 p.m.	8 p.m. through 8:59 p.m.
16	9 p.m.	9 p.m. through 9:59 p.m.
17	10 p.m.	10 p.m. through 10:59 p.m.
18	11 p.m.	11 p.m. through 11:59 p.m.
19	12 Midnight	12 a.m. through 12:59 a.m.
20	1 a.m.	1 a.m. through 1:59 a.m.
21	2 a.m.	2 a.m. through 2:59 a.m.
22	3 a.m.	3 a.m. through 3:59 a.m.
23	4 a.m.	4 a.m. through 4:59 a.m.
24	5 a.m.	5 a.m. through 5:59 a.m.

* For some MOBILE6 hourly input parameters, overnight hours are grouped. Hourly inputs are representative of the same day or day type, but are reordered for input to MOBILE6 to start at 6 a.m.

Application of MOBILE6 Commands and Associated Input Parameters

All of the MOBILE6 commands that may affect emissions factor calculations (and some commands that affect only the output format or content) are listed and described in Tables 19 through 25. Respectively, these seven tables are: MOBILE6 Pollutants and Emission Rates, MOBILE6 External Conditions, MOBILE6 Vehicle Fleet Characteristics, MOBILE6 Activity,

MOBILE6 State Programs, MOBILE6 Fuels, and MOBILE6 Alternative Emissions Regulations and Control Measures. These tables identify the combinations of MOBILE6 commands and parameters used.

Parameters associated with each MOBILE6 command are in general labeled as either EPA default, locality- (or county- or region-) specific, or NOT APPLIED. The tabulated commands where associated input parameters are labeled only as “EPA default” are generally not input for this analysis. References to MOBILE6 technical reports (available on the EPA MOBILE website [<http://www.epa.gov/otaq/models/mobile6/m6tech.htm>]) pertaining to particular commands/input parameters are provided in the tables.

The procedures used to develop the locality-specific inputs to MOBILE6 are detailed following the seven MOBILE6 input category tables.

Table 19
MOBILE6 Pollutants and Emission Rates

Command	Function/Description	Input Parameter Source/Value
POLLUTANTS	Defines the basic set of pollutants to report.	NOT APPLIED. (The MOBILE6 default is assumed: HC, CO, NOx.)
PARTICULATES	Enables computation of particulate matter (PM) and related emissions factors.	NOT APPLIED.
PARTICULATE EF	Specifies location of files that contain the particulate emissions factors when PARTICULATES command is used.	NOT APPLIED.
PARTICLE SIZE	Allows user to specify the maximum particulate size cutoff used by MOBILE.	NOT APPLIED.
EXPRESS HC AS VOC	One of five possible commands allowing the user to specify the particular HC species (non-methane HC, non-methane organic gases, total HC, total organic gases, VOC) to report in the exhaust emissions output.	“VOC” command is applied. Only the command is required.
NO REFUELING	Directs MOBILE6 not to calculate refueling emissions factors.	This command is applied. Only the command is required.
AIR TOXICS	Enables the computation of air toxic emissions factors (six explicit pollutants) and specifies which to calculate.	NOT APPLIED.
ADDITIONAL HAPS	Allows entry of emissions factors or air toxic ratios for calculation of additional user-defined air toxic pollutant emissions factors.	NOT APPLIED.
MPG ESTIMATES	Allows entry of alternate fuel economy performance data by vehicle class and model year.	NOT APPLIED. (MOBILE6 default values are assumed.)

Table 20
MOBILE6 External Conditions

Command	Function/Description	Input Parameter Source/Value
CALENDAR YEAR	Identifies calendar year for which emissions factors are to be calculated. (Required to run model).	2000
EVALUATION MONTH	Provides option of calculating January 1 or July 1 emissions factors for calendar year of evaluation.	7 (for July)
MIN/MAX TEMPERATURE	Sets minimum and maximum daily temperatures. (Required to run model if the HOURLY TEMPERATURES command is not used.)	NOT APPLIED. (See HOURLY TEMPERATURES.)
HOURLY TEMPERATURES	Allows temperatures input for each hour of day. (Required to run model if MIN/ MAX TEMPERATURE command is not used.)	County-specific by episode day, provided by TCEQ (see Appendix E).
ALTITUDE	Specifies high- or low-altitude for modeling area.	NOT APPLIED. (EPA default, low altitude, is assumed).
ABSOLUTE HUMIDITY	Used to specify daily average humidity (directly affects NOx emissions). MOBILE6 also converts absolute humidity to heat index which affects HC and CO emissions for the portion of the fleet that MOBILE6 determines is using air conditioning.	NOT APPLIED. (See RELATIVE HUMIDITY.)
<u>Environmental Effects on Air Conditioning:</u>	Commands used by MOBILE6 to model the extent of vehicle air-conditioning usage.	
CLOUD COVER	Specifies average percent cloud cover for given day.	NOT APPLIED. (EPA default assumed.)
PEAK SUN	Specifies mid-day hours with peak sun intensity.	NOT APPLIED. (EPA default assumed.)
SUNRISE/SUNSET	Allows user to specify time of sunrise and sunset.	Region-specific, 7 a.m. and 8 p.m., TCEQ.
RELATIVE HUMIDITY	Specifies use of 24 hourly relative humidity values entered by user. MOBILE6 will perform hour-specific calculations with hourly values rather than use single daily default absolute humidity value.	Region-specific by episode day date, provided by TCEQ (see Appendix E). TTI formatted data into model input sequence: 6 a.m. to 12 a.m. followed by 12 a.m. to 6 a.m. for the same day.
BAROMETRIC PRES	Specifies use of user input daily average barometric pressure for use with hourly relative humidity to calculate hourly absolute humidity values.	County-specific by episode day, provided by TCEQ (see Appendix E).

Table 21
MOBILE6 Vehicle Fleet Characteristics

Command	Function/Description	Input Parameter Source/Value
REG DIST	Allows the user to supply registration distributions by age for any of the 16 composite (combined gasoline and diesel) vehicle types.	<p>Locality-Specific/EPA default. Developed by TTI using mid-year 2002 TxDOT registrations data.</p> <p>Three registrations distributions were applied: Harris County; Brazoria, Fort Bend, Galveston, and Montgomery aggregate; and Chambers, Liberty, and Waller aggregate. For buses, the MOBILE6 default is used. See Appendix F.</p>
DIESEL FRACTIONS	Permits user to supply locality-specific diesel fractions for 14 of the 16 composite vehicle categories by age.	<p>Locality-Specific/EPA default. Developed by TTI. Beginning in 2002, TxDOT registrations specify gasoline- and diesel-fueled vehicles for the eight HDV classes.</p> <p>Mid-year 2002 TxDOT statewide registrations were used to develop one set of HDV diesel fractions (EPA defaults were applied for the remaining classes) for all three areas. The 2001 and 2002 diesel fractions are dropped and the earliest model year fractions are applied to previous years to complete the 25 model year data set. See Appendix F.</p>
MILE ACCUM RATE	Allows the user to supply the annual mileage accumulation rates by vehicle type and age.	NOT APPLIED. (EPA defaults are assumed — see technical report M6FLT.007)
NGV FRACTION	Lets user specify percent of natural gas vehicles (NGV) in the fleet by type and age certified to operate on either compressed or liquefied natural gas.	NOT APPLIED. (The EPA default, zero percent, is assumed.)
NGV EF	Permits the user to enter alternate NGV emissions factors for each of the 28 vehicle types, for running and start emissions.	NOT APPLIED. (The EPA default, none, is assumed.)

Table 22
MOBILE6 Activity

Command	Function/Description	Input Parameter Source/Value
VMT FRACTIONS	Used in MOBILE6 to weight the emissions of various vehicle types into average rates for groupings of vehicle classes.	NOT APPLIED. (EPA default assumed, used for aggregate results with no impact on this analysis. VMT mix is applied to link VMT outside MOBILE6 later in the process to calculate emissions by the 28 vehicle types.)
VMT BY FACILITY	VMT fractions by MOBILE6 road type combine the four road type emissions factors into the “all road types” emissions factors.	NOT APPLIED. (EPA default assumed, used for aggregate results with no impact on this analysis.)
VMT BY HOUR	Allows VMT fractions allocation by hour-of-day; applied in conversion of grams per hour (g/hr) to g/mi, as well as in weighting of hourly g/mi rates to obtain daily emissions factors.	Region-specific by day-type. The hourly VMT fractions were produced from the hourly link VMT estimates, by county. See Appendix G.
SPEED VMT	Allows user to allocate VMT by average speed (14 pre-selected: 2.5 and 5 through 65 at 5 mph increments) for arterials and freeways for each hour of the day.	Generic input. Same for all counties. Inputs are set up to calculate emissions factors by 14 MOBILE6 speed bin speed scenarios for MOBILE6 Freeway and Arterial road types.
AVERAGE SPEED	Allows a single average speed for combined freeways and arterials for the entire day.	NOT APPLIED.
STARTS PER DAY	Lets user specify the average number of engine starts per vehicle per day by vehicle types for weekend days and weekdays.	NOT APPLIED (EPA weekday or weekend defaults assumed — see technical report M6FLT.003.)
START DIST	Allows user to allocate engine starts by hour of the day for weekend days and weekdays.	NOT APPLIED (EPA weekday or weekend default assumed — see technical report M6FLT.003.)
SOAK DISTRIBUTION	Allows use of alternate vehicle soak duration distributions for weekend days and weekdays.	NOT APPLIED (EPA weekday or weekend defaults assumed — see technical report M6FLT.003 and 004.)
HOT SOAK ACTIVITY	Allows users to specify a hot soak duration distribution for each of 14 daily time periods for weekend days and for weekdays.	NOT APPLIED (EPA weekday or weekend defaults assumed — see technical report M6FLT.003 and 004.)
DIURN SOAK ACTIVITY	Allows user set diurnal soak time distributions for each of 18 daily time periods.	NOT APPLIED. (EPA defaults assumed — see technical report M6FLT.006.)
WE DA TRI LEN DI	Specifies alternate fractions of VMT that occur during trips of various durations at each hour of the average weekday.	Locality Specific. Used latest distributions developed by HGAC.
WE EN TRI LEN DI	Specifies hourly alternate fractions of VMT for trips of various lengths for weekend days.	Locality Specific. Used latest distributions (same set as used above for “WE DA TRI LEN DI”) developed by HGAC.
WE VEH US	Directs MOBILE6 to use weekend activity data for calculating emissions factors.	Applied command for weekend day analyses.

Table 23
MOBILE6 State Programs

Command	Function/Description	Input Parameter Source/Value
STAGE II REFUELING	Allows modeling of at-the-pump refueling emissions.	NOT APPLIED. Accounted for as an area source category.
ANTI-TAMP PROG	Allows user to model impacts of an ATP.	Locality Specific. Program design, by county (modeled for Harris County only). See Table 29.
<u>I/M Commands:</u> I/M PROGRAM I/M MODEL YEARS I/M VEHICLES I/M STRINGENCY I/M COMPLIANCE I/M WAIVER RATES I/M CUTPOINTS I/M EXEMPTION AGE I/M GRACE PERIOD NO I/M TTC CREDITS I/M EFFECTIVENESS I/M DESC FILE	Required for exhaust/evaporative I/M programs. Required for exhaust/evaporative I/M programs. Required for exhaust/evaporative I/M programs. Required for exhaust. Do not use for evaporative. Required for exhaust. Optional for evaporative. Required for exhaust. Optional for evaporative. Optional for exhaust (but required for IM240). Do not use with evaporative. Optional for both exhaust and evaporative. Optional for both exhaust and evaporative. Optional for exhaust. Do not use with evaporative. Optional for exhaust. Do not use with evaporative. Optional for both.	Locality Specific. Program design, by county. Exhaust and Evaporative modeled for Harris County; evaporative modeled for other seven counties. See Table 30.

Table 24
MOBILE6 Fuels

Command	Function/Description	Input Parameter Source/Value
FUEL PROGRAM	Allows specification of one of four options: 1) Conventional Gasoline East Tier 2 sulfur phase-in schedule (includes Texas); 2) Reformulated Gasoline (RFG); 3) Conventional Gasoline West Tier 2 sulfur geographical phase-in area schedule; or 4) Sulfur content for gasoline after 1999.	Option 2: Applied for all counties.
SULFUR CONTENT	(or GASOLINE SULFUR) Allows use of alternate sulfur content for conventional gasoline through calendar year 1999.	NOT APPLIED. (See FUEL PROGRAM Option above).
DIESEL SULFUR	Allows use of average diesel fuel sulfur level for all calendar years. Required if PARTICULATES command is used. No affect on HC, CO, NOx or air toxics (except if calculated as ratio to PM).	NOT APPLIED.
OXYGENATED FUELS	Allows modeling of oxygenated gasoline effects on exhaust for all gasoline-fueled vehicle types. Not for use with AIR TOXICS command.	NOT APPLIED.
FUEL RVP	Allows user to specify fuel RVP for area being modeled (required to run model).	EPA default RFG is applied through FUEL PROGRAM command. The EPA RFG default RVP is 6.7 psi. This value overrides RUEL RVP command input value. 6.7 psi (EPA RFG default RVP).
SEASON	Identifies effective season for RFG calculation regardless of month modeled.	NOT APPLIED.
GAS AROMATIC%	Only when AIR TOXICS command is used.	NOT APPLIED.
GAS OLEFIN%	Only when AIR TOXICS command is used.	NOT APPLIED.
GAS BENZENE%	Only when AIR TOXICS command is used.	NOT APPLIED.
E200	Only when AIR TOXICS command is used.	NOT APPLIED.
E300	Only when AIR TOXICS command is used.	NOT APPLIED.
OXYGENATE	Only when AIR TOXICS command is used.	NOT APPLIED.
RVP OXY WAIVER	Only when AIR TOXICS command is used.	NOT APPLIED.

Table 25
MOBILE6 Alternative Emissions Regulations and Control Measures

Command	Function/Description	Input Parameter Source/Value
NO CLEAN AIR ACT	Models vehicle emissions as if the Federal Clean Air Act Amendments of 1990 had not been implemented.	NOT APPLIED.
<u>HDDV NOx Off-Cycle Emissions Effects:</u> NO DEFEAT DEVICE NO NOX PULL AHEAD NO REBUILD REBUILD EFFECTS	Turns off the effects of the HDD vehicle NOx off-cycle emissions effects (defeat device emissions). Turns off HDD NOx emissions reduction effects of Pull-Ahead program. Turns off HDD NOx emissions reduction effects of Rebuild program. Allows user change Rebuild program effectiveness rate.	NOT APPLIED. NOT APPLIED. NOT APPLIED. Alternate actual national 2001 estimate, 0.01, is used (TCEQ).
<u>Tier 2 Emission Standards and Fuel Requirements:</u> NO TIER2 T2 EXH PHASE-IN T2 EVAP PHASE-IN T2 CERT	Allow the overriding of the default Tier 2 emissions standards and fuel requirements settings. Disables Tier 2 requirements. Allows alternate Tier 2 exhaust standard phase-in schedules. Allows alternate Tier 2 evaporative standard phase-in schedules. Allows user to specify alternate Tier 2 50,000-mile certification standards.	NOT APPLIED.
94+ LDG IMPLEMENTATON	Allows use of alternate 1994 and later fleet penetration fractions for LDGVs under the Tier 1, NLEV (or California LEV 1), and Tier 2 emissions standard programs.	NOT APPLIED.
NO 2007 HDDV RULE	Disables 2007 HDV emissions standards.	NOT APPLIED.

External Conditions — Locality-Specific Inputs to MOBILE6

MOBILE6 local inputs for hourly temperatures, hourly relative humidity, and sunrise and sunset times were developed and applied by calendar day based on local (central daylight) time. TCEQ developed these data and TTI formatted them for input to MOBILE6.

Temperatures (HOURLY TEMPERATURES Command)

TCEQ developed ambient hourly temperatures (degrees Fahrenheit) for input to MOBILE6 by county for each of the analysis days, August 18, 2000 through September 6, 2000. The temperatures are hourly averages from monitoring stations within the HGA counties. TCEQ used monitoring data from the EPA Aerometric Information Retrieval System, the National Weather Service, and Conrad Blucher Institute weather stations. Each county with more than one monitoring station uses the hourly average temperatures from the monitoring stations within its

border. Counties without monitoring stations (Fort Bend, Liberty, Waller), use average hourly temperatures from monitoring stations from adjacent counties.

The MOBILE6 User's Guide states that the 24 hourly temperature inputs are to be entered from 6 a.m. continuing through 5 a.m. of the "next day." The emissions estimation method applied by TTI, however, applies the hourly input data by "calendar day." This calendar day method simplifies the emissions estimation process, especially when modeling consecutive calendar days exhibiting different hourly travel activity. Thus, the hourly average temperatures for each calendar day provided by TCEQ were sequenced starting with 6 a.m. through 11:59 p.m. followed by 12 a.m. through 5:59 a.m. of the same calendar day. The temperatures input are for central daylight time (local time).

Modeling eight counties for 20 days results in 160 hourly temperature datasets. The temperatures are input in the MOBILE6 command file. A summary of the temperatures used are found in Appendix E.

Humidity (RELATIVE HUMIDITY Command)

The RELATIVE HUMIDITY command was used to specify hourly percent relative humidity values for each of the eight counties.

TCEQ developed hourly relative humidity input values essentially following the hourly temperature input development procedure and using data available from the stations described in the hourly temperature discussion above. Many of these stations do not record humidity; humidity data from adjacent counties were used for the counties with no humidity data available. The humidity parameter is input in the MOBILE6 command file. Appendix E shows the humidity values used.

Sunrise and Sunset Times (SUNRISE/SUNSET Command)

The SUNRISE/SUNSET Command allows the user to specify the time of sunrise and sunset. This feature affects only the air-conditioning correction. TCEQ provided the sunrise and sunset times which are the same for all counties and days. The times are 7 a.m. and 8 p.m. central daylight time.

Barometric Pressure (BAROMETRIC PRES Command)

The BAROMETRIC PRES command was used to specify the 24-hour average barometric pressure value (in units of inches of Mercury) by county and episode analysis day.

The daily barometric pressure inputs were developed by TCEQ by averaging the hourly barometric pressure data for each day (based on local time) from the weather stations with available barometric pressure data. As was the case for temperature and humidity inputs for counties without available data, values from adjacent counties were applied. The barometric pressure is input in the MOBILE6 command file. Appendix E shows the barometric pressure input values.

Vehicle Fleet Characteristics

Vehicle registration (age) distributions and diesel fractions inputs to MOBILE6 were developed from TxDOT mid-year 2002 county vehicle registration data (this is the first year that TxDOT has provided actual mid-year HDV registrations according to the EPA eight weight classes for each fuel type, gasoline and diesel) for those vehicle types where TxDOT registrations data were available. EPA defaults were used where necessary. Due to sparse registration data for some vehicle classes resulting from the increased disaggregation level of the vehicle classifications in MOBILE6 (28 vehicle types versus the previous eight vehicle class scheme), the registrations data are aggregated in three groups (Harris County; Urban county group: Brazoria, Fort Bend, Galveston, Montgomery; Rural county group: Chambers, Liberty, Waller) for developing the age distributions input, and grouped for the state for developing the diesel fractions inputs.

Vehicle Registration Distributions (REG DIST Command)

The user-supplied vehicle registration distributions input to MOBILE6 are by vehicle age for any of the 16 composite (combined gas and diesel) vehicle types as shown in Table 26. EPA default distributions are internally applied by MOBILE6 for vehicle classes for which the user does not provide alternate values. The input values for each vehicle class are 25 age fractions representing the fraction of vehicles by age for that particular vehicle class as of July of the evaluation year. These age fractions start with the evaluation year as the 1st age fraction and work back in annual increments to end with the 25th fraction, which represents the fraction of vehicles of age 25 years and older. The fractions are calculated as the model year-specific registrations in a class divided by the total vehicles registered in that class.

Table 26
Composite Vehicle Classes for Vehicle Registration Data
(REG DIST Command)

Number	Abbreviation	Description
1	LDV	Light-Duty Vehicles (Passenger Cars)
2	LDT1	Light-Duty Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
3	LDT2	Light-Duty Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
4	LDT3	Light-Duty Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW*)
5	LDT4	Light-Duty Trucks 4 (6,001-8,500 lbs. GVWR, 5,751 lbs. and greater ALVW)
6	HDV2B	Class 2b Heavy-Duty Vehicles (8,501-10,000 lbs. GVWR)
7	HDV3	Class 3 Heavy-Duty Vehicles (10,001-14,000 lbs. GVWR)
8	HDV4	Class 4 Heavy-Duty Vehicles (14,001-16,000 lbs. GVWR)
9	HDV5	Class 5 Heavy-Duty Vehicles (16,001-19,500 lbs. GVWR)
10	HDV6	Class 6 Heavy-Duty Vehicles (19,501-26,000 lbs. GVWR)
11	HDV7	Class 7 Heavy-Duty Vehicles (26,001-33,000 lbs. GVWR)
12	HDV8A	Class 8a Heavy-Duty Vehicles (33,001-60,000 lbs. GVWR)
13	HDV8B	Class 8b Heavy-Duty Vehicles (>60,000 lbs. GVWR)
14	HDBS	School Buses
15	HDBT	Transit and Urban Buses
16	MC	Motorcycles (All)

* The ALVW is the numerical average of the vehicle curb weight and the GVWR.

Source: MOBILE6 User's Guide (EPA, January 2002).

TTI developed MOBILE6 age distributions fractions input from TxDOT data for all vehicle types except for the two bus categories. EPA defaults were used for the two bus categories. To develop these distributions, TTI used two county-level data sets provided by TxDOT. The TxDOT registrations data provided are summarized as:

- July 2002 registrations for:
gasoline and diesel: LDV, LDT12, LDT34, MC, HDGT, HDDT; and
- July 2002 registrations for:
gasoline: HDV2B, HDV3, HDV4, HDV5, HDV6, HDV7, HDV8A, HDV8B; and
diesel: HDV2B, HDV3, HDV4, HDV5, HDV6, HDV7, HDV8A, HDV8B.

The July 2002 registrations are for: automobiles, light duty trucks (LDT12, corresponding to MOBILE6 classes LDT1 and LDT2), heavier light-duty trucks (LDT34, corresponding to MOBILE6 classes LDT3 and LDT4), motorcycles, heavy-duty gas trucks (> 8,500 lbs. GVWR), and heavy duty diesel trucks (> 8,500 lbs. GVWR). The July 2002 gasoline and diesel HDV classes (eight each) comprise the July 2002 HDGT and HDDT classes represented in the July

2002 data set, respectively, and correspond to the eight HDV weight classes for numbers six through 13 in Table 26.

First, the county registrations data for the eight counties were aggregated into three groups as previously described (Harris; Urban group: Brazoria, Fort Bend, Galveston, Montgomery; Rural group: Chambers, Liberty, Waller). Next, there are three steps to developing the MOBILE6 registration distributions input for the 14 non-bus vehicle classes. The first step in the process develops the July 2002 registrations by the 25 age groups for 12 of the 16 composite (by fuel) vehicle classes (eight HDV, LDV, LDT12, LDT34, MC). The second step converts the registrations from numbers of vehicles registered, to fractions registered by age for each of these 12 classes. The registrations are then expanded from 12 to 14 vehicle classes.

The 16 HDV class registrations were combined into the MOBILE6 eight composite (gasoline and diesel) classes by summing the individual fuel type registrations by age within each weight category. The 1978 and older registrations were summed to yield the “age 25 and older” registrations for each of the 12 composite vehicle classes (i.e. the eight HDV classes plus LDV, LDT12, LDT34, and MC).

The conversion of the registrations from numbers of vehicles to fractions of vehicles by age was made for each vehicle class by dividing the registrations for each age by the total registrations. MOBILE6 requires that the age distribution fractions for each vehicle class sum to one. In this step the age distribution fractions for each class were summed. For sums not equal to one (due to rounding error), the largest registration fraction was adjusted to make the fractions sum to one.

The resulting July 2002 estimated registration distribution fractions for the 12 composite classes were then expanded to 14 classes. This was accomplished by using the LDT12 age fractions, for both the MOBILE6 LDT1 and LDT2 classes and the LDT34 age fractions for both the MOBILE6 LDT3 and LDT4 classes. The MOBILE6 vehicle registration distributions are input from external data files. The external data files were provided to TCEQ on CD-ROM. Appendix A lists the data files submitted. Appendix F lists the registration distributions input.

Diesel Fractions (DIESEL FRACTIONS Command)

The DIESEL FRACTIONS command allows the user to specify diesel fractions for 14 of the 16 composite (gasoline and diesel) vehicle categories by vehicle age. MOBILE6 assumes that urban/transit buses are 100 percent diesel, and that motorcycles are all gasoline fueled, so these two categories do not require diesel fractions. The diesel fraction represents the portion of diesels in a composite (gasoline and diesel) vehicle class for any vehicle age. When the user enters diesel fractions, all 14 sets of fractions are required. Each set of fractions contains the diesel fractions for 25 vehicle ages from the evaluation year back through the 25th fraction, which represents vehicle ages of 25 years and older.

The MOBILE6 default fractions vary by age for model years 1972 through 1996. For 1971 and earlier model years, the default diesel fractions are assumed the same as the 1972 model year

fractions. For the 1997 and later model years, the default diesel fractions are assumed the same as the 1996 model year fractions.

TTI developed evaluation year-specific, state-level diesel fractions inputs for the analysis. TTI used a combination of estimated TxDOT diesel fractions and EPA default diesel fractions for modeling the emissions factors. Table 27 shows the MOBILE6 diesel fractions input categories with corresponding data sources. The diesel fraction estimates were calculated based on TxDOT individual diesel and gasoline vehicle registrations for the eight HDV (HDV2b through HDV8b) weight classes. To produce the HDV diesel fractions by model year, the diesel registrations were divided by the sum of the gasoline and diesel registrations, by HDV composite vehicle class, and model year.

Table 27
Source of Diesel Fractions for Composite Vehicle Types
(DIESEL FRACTIONS Command)

Number	Abbreviation	Description	Source of Fractions
1	LDV	Light-Duty Vehicles	EPA MOBILE6 Evaluation Year Default
2	LDT1	Light-Duty Trucks 1	EPA MOBILE6 Evaluation Year Default
3	LDT2	Light-Duty Trucks 2	EPA MOBILE6 Evaluation Year Default
4	LDT3	Light-Duty Trucks 3	EPA MOBILE6 Evaluation Year Default
5	LDT4	Light-Duty Trucks 4	EPA MOBILE6 Evaluation Year Default
6	HDV2B	Class 2b Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
7	HDV3	Class 3 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
8	HDV4	Class 4 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
9	HDV5	Class 5 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
10	HDV6	Class 6 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
11	HDV7	Class 7 Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
12	HDV8A	Class 8a Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
13	HDV8B	Class 8b Heavy-Duty Vehicles	TxDOT July, 2002 Statewide Registrations
14	HDBS	School Buses	EPA MOBILE6 Evaluation Year Default

To estimate the 2000 analysis year HDV diesel fractions, the 2001 and 2002 model year fractions were removed and the oldest model year fractions in the data set were used for each earlier model year to complete the diesel fractions data set to the 25th model year for each vehicle class. The estimated 2000 HDV diesel fractions were then combined with the corresponding evaluation year-specific EPA default diesel fractions for the remaining vehicle classes (LDV, LDT1, LDT2, LDT3, LDT4, and HDBS) to produce the complete input data set. Diesel fractions are entered in the MOBILE6 command file. The diesel fractions input is shown in Appendix F.

Activity

The locality-specific activity inputs applied to develop the MOBILE6 hourly emissions factors are the fleet total hourly VMT fractions (by county and day type), and average hourly weekday trip length distributions (one set for the area used for all analysis days).

Additional non-default, but generic activity inputs used in the modeling were hourly fractions of VMT by the 14 speeds for arterials and freeways (SPEED VMT command). Also, weekend day hourly vehicle usage rates (MOBILE6 defaults) for particular activity input parameters (through the WE VEH US command) were applied for the Saturday and Sunday episode days.

VMT Fractions (Also Known as VMT Mix)

These sets of fractions (VMT fractions attributable to individual vehicle classes) are an input to MOBILE6, however, the method for this study calls for the application of the VMT mix (or mixes) later in the emissions calculation process. VMT mix development was discussed previously in this documentation.

Total VMT by Hour (VMT BY HOUR Command)

Hourly fleet total VMT distributions are input to MOBILE6 by using the VMT BY HOUR command. These fractions are used by MOBILE6 to convert the units of the non travel-related hourly emissions factors (e.g., hot soak, diurnal, start, etc.) to units of g/mi. (The VMT by hour fractions are also used to produce the daily emissions factors as composites of the hourly emissions factors.)

The hourly link-VMT estimates by day-type (discussed previously in the “Estimation of VMT” section) were used to develop the MOBILE6 fleet hourly VMT input. One set of 24 fractions was developed for each of the four day types for each county (i.e., 32 input data sets). The fractions are calculated by dividing the county fleet total VMT for each hour by the county fleet total 24-hour VMT.

These fractions are input to MOBILE6 as an external data file. Appendix G lists the hourly travel factors. The factors in MOBILE6 external data file format are provided on CD-ROM, as described in Appendix A.

VMT Distribution by Average Speed on Freeways and Arterials (SPEED VMT Command)

The VMT distributions by average speed inputs are called by the SPEED VMT command, but are accommodated internally by the POLFAC62 program (that is, no user speed input commands or data parameter values are required when producing MOBILE6 emissions factors tables with POLFAC62). POLFAC62 uses the SPEED VMT inputs to produce the individual Freeway and Arterial emissions factors indexed by the 14 MOBILE6 speed bin speeds.

There are 14 scenarios, each with 100 percent of Freeway and Arterial VMT set to one of the 14 MOBILE speed bin speeds. Each scenario produces a set of Arterial and Freeway emissions factors corresponding to one of the 14 speeds.

Trip Length Distributions by Hour of Day (WE DA TRI LEN DI Command)

The trip length distributions (TLDs) input to MOBILE6 is called by the WE DA TRI LEN DI (for weekdays) command, or by the WE EN TRI LEN DI (for weekend days) command. TLDs specify the percentage of average weekday (or weekend) VMT that occurs during trips of different durations at each hour of the day.

The VMT distributions are entered as percentages of VMT for six trip length ranges, and must sum to 100 percent. The percentage values correspond to VMT accumulated within the trip duration ranges:

- Under 10 minutes,
- 11-20 minutes,
- 21-30 minutes,
- 31-40 minutes,
- 41-50 minutes, and
- 51 minutes and longer.

HGA regional TLDs were applied for this analysis (Table 28). These TLDs were taken from the report “Conformity Determinations for The 2022 Metropolitan Transportation Plan and the 2000-2022 Transportation Improvement Program for Houston-Galveston Transportation Management area,” March 23, 2000 prepared by HGAC. These are the latest available TLD estimates. No weekend day TLD data were available, thus the weekday values shown in Table 28, were applied for all of the analysis days. The HGA area-wide hourly TLD data were input to MOBILE6 in an external data file.

TABLE 28
HGA Percent of VMT by Trip Length, Hourly

Hour	Trip Length Ranges (minutes)					
	< 10	11-20	21-30	31-40	41-50	>51
6 a.m.	13.1	28.4	24.0	14.9	08.4	11.2
7 a.m.	08.9	21.5	23.2	18.6	12.6	15.2
8 a.m.	08.9	21.5	23.2	18.6	12.6	15.2
9 a.m.	13.9	29.8	24.4	14.5	07.8	09.6
10 a.m.	13.9	29.8	24.4	14.5	07.8	09.6
11 a.m.	13.9	29.8	24.4	14.5	07.8	09.6
12 p.m.	13.9	29.8	24.4	14.5	07.8	09.6
1 p.m.	13.9	29.8	24.4	14.5	07.8	09.6
2 p.m.	13.9	29.8	24.4	14.5	07.8	09.6
3 p.m.	13.9	29.8	24.4	14.5	07.8	09.6
4 p.m.	11.1	24.6	23.1	16.8	10.8	13.6
5 p.m.	11.1	24.6	23.1	16.8	10.8	13.6
6 p.m.	11.1	24.6	23.1	16.8	10.8	13.6
7 p.m. through 5 a.m.	13.1	28.4	24.0	14.9	08.4	11.2

Weekend Day Vehicle Usage (WE VEH US Command)

MOBILE6 is structured to supply either weekday or weekend day activity values for particular input parameters. Use of the WE VEH US directs MOBILE6 to select the weekend input parameter data sets for start distributions, soak distributions, hot soak activity, and TLDs. The WE VEH US command was used for the Saturday and Sunday episode analysis days. Thus for the Saturdays and Sundays, EPA default weekend usage rates were applied for start distributions, soak distributions, hot soak activity. The HGAC-developed local weekday TLDs were used for all analysis days.

State Programs

The state programs inputs to MOBILE6 models the effects of exhaust and evaporative vehicle I/M and vehicle ATP which apply to the gasoline-fueled vehicle classes, except motorcycles. During calendar year 2000, Harris County administered an ATP and exhaust and evaporative I/M, whereas the other seven counties administered the evaporative I/M. The ATP and I/M programs modeled for 2000 started January 1 of the program start years. The I/M and ATP

modeling set-ups were developed with information from the I/M SIP (TCEQ, December 2002) and discussions with TCEQ Technical Analysis Division.

Vehicle ATP (ANTI-TAMP PROG Command)

Table 29 describes the ATP set-ups and the emissions factor post-processing procedure required due to MOBILE6's limit of one ATP per modeling run. The post-processing procedure is from the HGA original 1990 base year emissions inventory as developed and documented by HGAC in 1992. For 2000, ATP credit was modeled for Harris County only. The MOBILE6 ATP set-ups are inputs of the MOBILE6 command file.

TABLE 29
Harris County 2000 ATP:
MOBILE6 Command, Data Parameter Values, and Post-processing Procedure

Post-processing requirements: Three MOBILE6 modeling runs are required to model the Harris County ATP program, which consists of two subprograms. To accommodate both parts of the ATP (ATP1, ATP2), a run with no ATP command is required as well as one run for each of the two ATPs. The following emissions factor post-processing calculation is performed with the output from the three model runs:

$$EF_{ATP1} + EF_{ATP2} - EF_{NO\ ATP} = EF_{FINAL}$$

Where:

EF_{ATP1} = emissions factor (EF) with ATP1 credits,
 EF_{ATP2} = EF with ATP2 credits,
 $EF_{NO\ ATP}$ = EF with no ATP credits,
 EF_{FINAL} = EF with estimated credits for both ATP1 and ATP2.

MOBILE6 Inputs: The command and data parameter values for ATP1 and ATP2, respectively, are:

ANTI-TAMP PROG
 84 76 83 22222 22222222 2 11 096. 21112222
 ANTI-TAMP PROG
 84 84 98 22222 22222222 2 11 096. 22112222

Data parameter value definitions:

- the first number is the last two digits of the program start year.
- the second number is the last two digits of earliest model year covered by the program. The program is designed to cover 24-year-old vehicles and newer.
- the third number is the final model year covered by the program. Vehicles less than two years old are exempt from the program.
- the next 14 values are on/off toggles to identify the vehicle types covered (1 = no, 2 = yes). The vehicle are in input string order are: LDGV, LDGT1, LDGT2, LDGT3, LDGT4; and HDGV2B, HDGV3, HDGV4, HDGV5, HDGV6, HDGV7, HDGV8A, HDGV8B; and GAS BUS.
- the next entry must be one (EPA no longer supports additional credit for test only program). A "2" will cause ATP credit to be discontinued.
- the next data parameter is the program inspection frequency (1 = annual, 2 = biennial).
- the next number is the program compliance rate in percent.
- the last eight data parameters in the input string are on/off toggles (1 = no, 2 = yes) indicating which checks are performed, in the following order: 1) air pump disablement, 2) catalyst removal, 3) fuel inlet restrictor removal, 4) tailpipe lead deposit, 5) exhaust gas recirculation disablement, 6) evaporative system disablement, 7) positive crankcase ventilation system disablement, and 8) missing gas cap.

I/M Programs

Table 30 describes the HGA I/M set-ups (commands and data parameter values) for 2000. For 2000, Harris County administered both exhaust and evaporative I/M programs, whereas the other seven HGA counties operated only the evaporative I/M program. Thus, for 2000, three I/M programs are modeled (MOBILE6 will model up to seven different I/M programs in one run). All I/M programs modeled for 2000 started in January of the program start years. The I/M data were input in an external data file called from the command file using the I/M DESC FILE command.

TABLE 30
MOBILE6 I/M Commands and Data Parameter Values for HGA 2000

Geographic coverage: Harris County: Programs 1 and 2; other seven counties: Program 3.

MOBILE6 inputs: The commands (in bold) with their corresponding data parameters values as defined by program design, are described below. Except for the I/M EFFECTIVENESS command, the first data value following each command identifies the program number to which the command and its associated parameters apply. Where the character “#” is the first value after a command, the command and associated data parameter values apply to all I/M program numbers (i.e., # takes the values 1, 2, and 3).

I/M STRINGENCY: 1 20 (percent stringency level for pre-1981 automobiles and light trucks)

I/M COMPLIANCE: # 96 (percent compliance)

I/M WAIVER RATES: # 3 3 (pre-1981 and post-1980 waiver rates in percent)

I/M EFFECTIVENESS: 1 1 1 (fractional exhaust I/M effectiveness for HC, CO, and NOx)

I/M PROGRAM:

1 1997 2050 1 TRC 2500/IDLE

2 1997 2050 1 TRC GC

3 2000 2050 1 TRC GC

Where the parameters, by numerical order, are defined as:

1st parameter is the I/M program number,

2nd and 3rd are the program start and end years, respectively,

4th is the program frequency (1 = annual, 2 = biennial),

5th is the program type (TRC = test and repair computerized),

6th is inspection type (2500/IDLE = test at idle, 2500 rpm; GC = gas cap pressure check).

I/M MODEL YEARS: # 1976 1998

I/M VEHICLES: # 22222 22222222 2

The 14 data parameters are on/off toggles (1 = no, 2 = yes) indicating which vehicle types are subject to inspection. The 14 corresponding vehicle types, in input order are: LDGV, LDGT1, LDGT2, LDGT3, LDGT4; and HDGV2B, HDGV3, HDGV4, HDGV5, HDGV6, HDGV7, HDGV8A, HDGV8B; and GAS BUS.

Fuels — Locality-Specific Inputs to MOBILE6

Fuel effects modeling for the HGA 2000 areas includes only the summer RFG. The RVP of gasoline is required input to run MOBILE6, but is not used in the emissions factor calculations, as it is overridden by the MOBILE6 RFG option modeled.

Fuel Program (FUEL PROGRAM Command)

The MOBILE6 FUEL PROGRAM command provides the user four options for modeling fuels effects. The second option, RFG (with the southern volatility region indicated), was modeled for all eight counties for 2000. This option directs MOBILE6 to model the effects of RFG as defined by the EPA default parameters for the southern volatility region, summer RFG. The EPA default RFG parameter values used are:

- RVP, South region - 6.7 pounds per square inch;
- Ether Oxygen Content - 2.1 percent by weight;
- Ether Market Share - 100 percent;
- Sulfur Content, average - 150 parts per million; and
- Sulfur Content, maximum experienced by model year:
 - Model Year 2000: 1,000 parts per million, and
 - Model Year \leq 1999: not applicable.

The selected FUEL PROGRAM option is entered in the MOBILE6 command file.

Gasoline RVP (FUEL RVP Command)

The gasoline RVP input to MOBILE6 is overridden by the selected FUEL PROGRAM command option described above for RFG, which inputs an RVP of 6.7 psi. This value was also entered as the RVP input corresponding to the FUEL RVP command. For comparison, the estimated actual average summertime RVP value for 2000 for the city of Houston is 6.8 pounds per square inch as calculated by TCEQ. TCEQ used procedures found in Procedures for Emissions Inventory Preparation, Volume IV (EPA, 1992), and gasoline survey data from TRW Petroleum Technologies to estimate the HGA average summertime RVP for 2000. The RVP value is entered in the MOBILE6 command file.

MOBILE6 Alternative Emissions Regulations and Control Measures Commands

The only non-default input and associated command applied in this part of MOBILE6 relates to heavy-duty diesel vehicle NOx off-cycle emissions effects.

In the late 1980s and most of the 1990s HDDV engines were built with “defeat devices” allowing in-use engine emissions to be higher than emissions as specified under Federal Test Procedure conditions. MOBILE6 includes estimates of these excess HDDV emissions as well as the emissions offsetting effects of two programs: early pull-ahead of 2004 HDDV emissions standards, and low emissions rebuilds of existing engines.

Using information provided by EPA, TCEQ estimated an effectiveness rate of 1.0 percent for the low NOx emissions rebuilds program for heavy-duty diesel trucks. The information provided by EPA showed that the percent of the affected HDV population on which the low NOx-rebuild

kits had been installed (as of January, 2002) was 0.97 percent. This value was assumed for 2000 as well. Thus, in MOBILE6 the effectiveness rate for the low NOx emissions rebuild program was set at 1.0 percent through the REBUILD EFFECTS command.

According to the above-described MOBILE6 input parameters and options, MOBILE6 input files were set up and run with the POLFAC62 program (with post-processing of output as required with RATEADJ62) for each analysis day. The resulting tabulated hourly emissions factors indexed by speed, MOBILE6 drive cycle, vehicle type, and pollutant-specific emissions type were input to the emissions calculation program, IMPSUM6. The modeled emissions factors are provided on CD-ROM. See Appendix A for file names and descriptions.

EMISSIONS CALCULATIONS

Hourly emissions were calculated at the network link level using the IMPSUM6 program (Appendix B). Generally, for each hour the episode day link-VMT estimates were multiplied by the episode day emissions factors (g/mi) to produce hourly emissions estimates for each of the 28 vehicle types and each pollutant on each network link (the MOBILE6 Freeway, Arterial or Ramp emissions factors were used depending on the link facility type code). For each day, 195 files were output from the emissions calculations: 192 hourly link emissions files (24 hours multiplied by eight counties), a summary file of county-level and area total hourly and 24-hour emissions estimates cross-classified by vehicle type and road type, a tab-delimited version of the emissions summary file, and the file that logged the execution of the emissions calculation programs. These files are provided on CD-ROM (see Appendix A).

Hourly Link Emissions

For each analysis day, the emissions were calculated by hour for each network and intrazonal link (indexed to county and road type) using the following basic inputs:

- MOBILE6 emissions factors indexed by pollutant, speed, emission type, hour, road type and vehicle type, as developed with POLFAC62 (and RATEADJ62);
- records associating the MOBILE6 drive-cycle-specific emissions factors with the appropriate functional classification codes (or facility type codes) used in the network links;
- link data from the assignment results as developed (for each hour) using the PREPIN2 program including: county number, functional classification (or facility type) number, VMT on link, operational link-speed estimate, link node (end point) numbers, and link distance; and
- VMT mix (to allocate link-VMT by each of the 28 vehicle types) by time period and roadway type.

For each county, day and hour, the emissions estimates were computed by vehicle type for each link. The analysis day emissions factors, discussed previously, were tabulated by pollutant, emissions type, hour, road type (drive cycle), vehicle type, and 14 speeds (2.5 mph and 5 mph to

65 mph at 5 mph intervals) for each county. The county coded hourly fleet total link VMT estimates were first stratified by vehicle type. The time period and functional classification group-specific VMT mixes were correlated to the appropriate links (by functional classification code and hour of day) and were multiplied by the fleet total link VMT to produce the hourly link VMT estimates by the 28 vehicle types. The emissions factors for each pollutant were then matched with appropriate link-level VMT based on road type drive cycle, vehicle class and speed. Since freeway ramps are not coded separately in the HGA TDM network (ramp volumes are included as part of the freeway volume estimate), composite freeway-freeway ramp emissions factors (using the MOBILE6 default 92 percent freeway to 8 percent ramp allocation, see Technical Guidance on the Use of MOBILE6 for Emission Inventory Preparation, EPA, January 2002) were calculated and applied to the freeway link VMT estimate to include the ramp drive cycle emissions component. Emissions factors for link speeds that are not represented in the set of 14 speed indexes were calculated by interpolation (see example calculation, Appendix B). For link speeds outside of the model speed range, emissions factors corresponding to the appropriate bounding speeds were applied. The link VMT were then multiplied by the emissions factors to produce the link-level emissions estimates.

Table 31 shows the HGA TDM network functional classification groupings used to allocate the MOBILE6 drive-cycle-specific emissions factors and VMT mix to the links based on facility type code. The four-period time-of-day-specific VMT mixes were applied by peak and off-peak periods where 6 a.m. to 10 a.m. is the three-hour AM Peak and 3 p.m. to 7 p.m. is the four-hour PM Peak. The day hours between the AM Peak and PM Peak use the Mid-Day period VMT mix and the night hours between the PM Peak and AM Peak use the Overnight VMT mix.

Table 31
HGAC TDM Functional Classification Groupings
for Application of VMT Mix and MOBILE6 Drive Cycle Emissions Factors

MOBILE6 Drive Cycle	TDM Functional Classification	VMT Mix
92 Percent Freeway and 8 Percent Freeway Ramp	Urban Interstate	Freeway
	Urban Other Freeway	
	Rural Interstate	
	Rural Other Freeway	
Arterial	Urban Principal Arterial	Arterial
	Urban Other Arterial	
	Rural Principal Arterial	
	Rural Other Arterial	
	Urban Collector	Collector
	Rural Major Collector	
	Rural Collector	
	Local (centroid connector)	
	Local (intrazonal)	

Episode Day Hourly and 24-hour Emissions Summaries

For each analysis day, by individual county and for all counties, the link-emissions estimates were summed for each hour, and the hourly emissions were summed for each day. The resulting composite VOC, CO, and NOx emissions estimates are summarized by road type (HGA network functional classification), vehicle type, road-type and vehicle-type cross-classification. VMT, vehicle hours traveled (VHT), VMT-weighted speeds, and other inventory data are included with the emissions summaries. These files (*.LST and a tab delimited version, *.TAB) are provided on CD-ROM (see Appendix A).

APPENDIX A
ELECTRONIC SUBMITTAL DATASET NAMES AND DESCRIPTIONS

ELECTRONIC SUBMITTAL DATA SET NAMES AND DESCRIPTIONS

This appendix describes the HGA 2000 modeling emissions inventory electronic data submittal. The HGA 2000 modeling emissions inventories data are contained on 21 CD-ROMs:

- 20 CD-ROMs containing the link-emissions files and inventory summary report files; and
- 1 CD-ROM containing:
 - HGA 2000 travel model network node coordinates;
 - MOBILE6 input and output files; and
 - a copy of this data description.

The link emissions file format with data definitions and codes is included in the tables at the end of this appendix.

EMISSIONS

One CD for each analysis day (20) contains the following files (195) in a ZIP file:

- county-level, hourly link-emissions files (192 ASCII files: * *.Thr* , *hr* = 01, 02,... 24);
- county-level, hourly emissions inventory data summaries to include VMT mix, VMT, VHT, average speed, and emissions cross-classified by vehicle type and road type; hourly “all counties” emissions inventory data summaries; county-level and “all counties” 24-hour emissions inventory data summaries (1 ASCII file, *.LST* extension);
- a tab-delimited version of second bullet above (1 ASCII file, *.TAB* extension); and
- a log of the emissions estimation program runs (1 ASCII file with *.LOG* extension).

The CD-ROM names, zip file names and data set file names follow the convention:

Hddmmm00 (CD-ROM name)

ddmmm00hga.zip

ddmmm2000hga_ems.tab

ddmmm2000hga_ems.lst

ddmmm2000hga_ems.log

mmmdd.2000CCCC_ems.Thr

Where:

dd is the day date for each of the 20 days for the period 18AUG through 06SEP;

mmm is the month, AUG or SEP, corresponding to the episode date day (*dd*);

CCCC is the first four letters of each of the eight subject county names; and

hr is 01... 24 representing the hours 12 a.m. through 11 p.m.

COORDINATES

The CD with the coordinates is HG00M6_XY. This CD contains a file named “HGAC2000coord.txt” that contains longitude and latitude in millionths of degrees for the

HGAC 2000 network nodes (link endpoints and zone centroids for use with the 2000 link emissions estimates). The order of the data is: network node number, longitude, and latitude.

EMISSIONS FACTORS

The CD-ROM is named HG00M6_XY. The MOBILE6 input/output files on the CD-ROM are in the ZIP file: HGA00M6.zip. The input/output files consist of these 719 files:

- MOBILE6 command input files (200 files):
 - ddmmm00_CTY7.in* (140 files);
 - ddmmm00_harr_a#.in* (60 files).
- MOBILE6 external data input files (39):
 - Harr02.rgd (1 Harris County registration distributions file);
 - Urba02.rgd (1 Urban County group registration distributions file);
 - Rura02.rgd (1 Rural County group registration distributions file);
 - Harr00.im (1 Harris County I/M file);
 - UrRu00.im (1 I/M file for other seven counties);
 - HGAsip.tld (1 regional weekday TLD file);
 - HGAsipWE.tld (1 file with same TLD as above, but specified for weekend days);
 - CTY8 00kk.vhr* (32 VMT BY HOUR files).
- MOBILE6 hourly emissions factor output files (220):
 - ddmmm2000_CTY8.rat* (160 final rate files);
 - ddmmm2000_harr_a#.rat* (60 interim Harris County rate files).
- MOBILE6 daily emissions factor output files (220)¹:
 - ddmmm2000_CTY8.rtd* (160 final rate files);
 - ddmmm2000_harr_a#.rtd* (60 interim Harris County rate files).
- Program run *.LOG files* and *.LST files²:
 - ddmmm2000hga_RT.LOG* (20 files);
 - ddmmm2000hga_RT.LST* (20 files).

Where:

CTY7 is the first four letters of the seven non-Harris County county names;
CTY8 is the first four letters of each of the eight county names;
ddmmm is the day date and month for each episode day (e.g., 18AUG, ... 06SEP);
kk is day-type (wk, fr, sa, su).

¹ MOBILE6 Daily Emissions Factors Files:

The set of 24-hour average emissions factor files (*.rtd) have no impact on the analysis. The “daily all roads” emissions factors (i.e., composites based on MOBILE6 default VMT by facility values) in the *.rtd files are invalid. The individual MOBILE6 road type (Freeway, Arterial, Local, Ramp) emissions factors are valid.

² Emissions Factor Log (*.LOG) and MOBILE6 Descriptive Output (*.LST) files:

The log files are a record of the emissions factor program (POLFAC62) runs (one file with .log extension). The MOBILE6 descriptive output is a record of the MOBILE6 descriptive output corresponding to each POLFAC62 run/scenario. The value of this output is in the listing of MOBILE6 inputs used; the emissions factors in this MOBILE6 descriptive output, however, are “daily all road types” values which are composed with the MOBILE6 default VMT BY FACILITY values, and thus are not valid.

Table 32
TDM Network Link Emissions Data File Format

Abbreviation	Columns	Format Type	Description
A Node	1 - 6	I6	A-Node of link
B Node	7 - 12	I6	B-Node of link
FC	13 - 15	I3	Functional Classification Code of Link (see Table 33)
EMISS	17 - 19	A3	“VOC,” or “CO,” or “NO _x ”
ETYPE	21 - 31	A11	Emissions Sub-Component Type (see Table 34)
LDGV	32 - 41	F10.? [*]	LDGV link emissions in grams
LDGT1	42 - 51	F10.?	LDGT1 link emissions in grams
LDGT2	52 - 61	F10.?	LDGT2 link emissions in grams
LDGT3	62 - 71	F10.?	LDGT3 link emissions in grams
LDGT4	72 - 81	F10.?	LDGT4 link emissions in grams
HDGV2B	82 - 91	F10.?	HDGV2B link emissions in grams
HDGV3	92 - 101	F10.?	HDGV3 link emissions in grams
HDGV4	102 - 111	F10.?	HDGV4 link emissions in grams
HDGV5	112 - 121	F10.?	HDGV5 link emissions in grams
HDGV6	122 - 131	F10.?	HDGV6 link emissions in grams
HDGV7	132 - 141	F10.?	HDGV7 link emissions in grams
HDGV8A	142 - 151	F10.?	HDGV8A link emissions in grams
HDGV8B	152 - 161	F10.?	HDGV8B link emissions in grams
LDDV	162 - 171	F10.?	LDDV link emissions in grams
LDDT12	172 - 181	F10.?	LDDT12 link emissions in grams
HDDV2B	182 - 191	F10.?	HDDV2B link emissions in grams
HDDV3	192 - 201	F10.?	HDDV3 link emissions in grams
HDDV4	202 - 211	F10.?	HDDV4 link emissions in grams
HDDV5	212 - 221	F10.?	HDDV5 link emissions in grams
HDDV6	222 - 231	F10.?	HDDV6 link emissions in grams
HDDV7	232 - 241	F10.?	HDDV7 link emissions in grams
HDDV8A	242 - 251	F10.?	HDDV8A link emissions in grams
HDDV8B	252 - 261	F10.?	HDDV8B link emissions in grams
MC	262 - 271	F10.?	MC link emissions in grams
HDGB	272 - 281	F10.?	HDGB link emissions in grams
HDDBT	282 - 291	F10.?	HDDBT link emissions in grams
HDDBS	292 - 301	F10.?	HDDBS link emissions in grams
LDDT34	302 - 311	F10.?	LDDT34 link emissions in grams

* The F10? format is either F10.0, F10.1, F10.2, F10.3, or F10.4. The format selected for a field is based on the value of the field.

Table 33
HGA Travel Model Network Functional Classification Names and Codes

1.	Urban Interstate Freeways
2.	Urban Other Freeways
5.	Urban Principal Arterials
6.	Urban Other Arterials
7.	Urban Collectors
8.	Locals (Centroid Connectors)
10.	Rural Interstate Freeways
11.	Rural Other Freeways
12.	Rural Principal Arterials
13.	Rural Other Arterials
14.	Rural Major Collectors
15.	Rural Collectors
0.	Locals (Intrazonals)

Table 34
Emissions Sub-Component Type

Sub-Component Abbreviation	Comments
COMPOSITE	Total emissions
EXH_RUNNING	Exhaust running emissions
START	Start emissions
Hot_Soak	Hot Soak VOC emissions
Diurnal	Diurnal VOC emissions
Rest_Loss	Resting loss VOC emissions
Run_Loss	Running loss VOC emissions
Crankcase	Crankcase VOC emissions
Refueling	Refueling loss VOC emissions

APPENDIX B
EMISSIONS ESTIMATION PROGRAMS

TTI EMISSIONS ESTIMATION PROGRAMS

The following is a summary of the series of programs developed by TTI for developing link-based, time-of-day, on-road mobile source emissions estimates for air quality analyses.

These programs produce emissions factors with the latest version of EPA's MOBILE emissions factor model, and apply them to travel model-based activity estimates to calculate emissions at user-specified temporal and spatial scales. The location of emissions by grid, or travel network link coordinates, may also be specified.

The emissions estimation programs are: PREPIN2, POLFAC62, RATEADJ62, RATEADJV62, IMPSUM6, and SUMALL6. PREPIN2 prepares activity input, POLFAC62 prepares emissions factor input, the RATEADJ programs make special adjustments to emissions factors when required, IMPSUM6 calculates emissions by time period, and SUMALL6 summarizes emissions at various levels by 24-hour period.

PREPIN2

The PREPIN program post-processes travel model output to produce time-of-day-specific, on-road vehicle fleet, link VMT and speed estimates for emissions inventory applications. The PREPIN program was developed for use in urban areas that do not have all of the time-of-day assignments and operational speeds available as may be required for air quality analyses of particular temporal scales (e.g., hourly). For example, PREPIN reads a travel demand model traffic assignment data set from a directional four period time-of-day assignment (another common assignment read by PREPIN is the nondirectional or directional 24-hour assignment). PREPIN initially scales the assignment volumes on each link to the appropriate VMT (seasonal, day-of-week specific, for instance). Time-of-day (hourly, for example) factors (and directional split factors, in the case of a nondirectional assignment) are applied to the adjusted assignment results on each link to estimate the directional time-of-day travel on the link. Speed models, originally developed for the Houston/Galveston region, are used to estimate the operational time-of-day speeds by direction on the links. Special intrazonal links are defined (as intrazonal links are not a feature of travel demand models), and the VMT and speeds for intrazonal trips are estimated. These VMT and speeds by link are subsequently input to the IMPSUM6 program for the application of MOBILE6 emissions factors.

POLFAC62

The POLFAC62 program is used to apply the EPA's MOBILE6 program (October 2002 version with additional pollutant capabilities) to calculate the on-road mobile emissions factors. The MOBILE6 emissions factors may be produced for each of the pollutant-specific emissions types (e.g., depending on the pollutant and vehicle type, the total composite, exhaust running, exhaust start, plus the six sub-component evaporative rates), 28 vehicle types, four MOBILE6 functional classifications (or drive cycles, i.e., Freeway, Arterial/Collector, Local, and Ramp), 14 speeds (i.e., 2.5 mph, and 5 mph through 65 mph at 5 mph increments for Freeway and Arterial functional classifications — MOBILE6 Local and Ramp functional classification rates are single speed only, 12.9 mph, and 34.6 mph, respectively), and each of the 24 hours of the day. The POLFAC62 emissions factors are average vehicle class rates calculated from the MOBILE6 database output by weighting the by-model-year emissions rates within each vehicle class by its

corresponding travel fraction. These emissions factors are tabulated individually by geographical area (county or county group) and analysis day for the evaluation year. These emissions factors are output to an ASCII file for subsequent input to the IMPSUM62 program. The IMPSUM62 program is then used to apply the hourly emissions factors to hourly VMT estimates by link. (POLFAC62 also optionally produces a set of daily emissions factors.) POLFAC62 also calculates the additional pollutant emissions factors provided by the MOBILE6 October 2002 version.

RATEADJ62

RATEADJ62 is a special utility program that produces a new set of emissions factors by linearly combining the emissions factors from multiple applications of POLFAC62. There is one set of linear factors. Each factor is applied to all emissions rates in a single data set.

A practical application of the RATEADJ program is the combining of two sets of emissions factors, where each set has different control program credits, into one set including the combined credits. For example, this program may be used to combine different ATP credits from two separate POLFAC62 runs into one set of emissions factors that includes the credits for both ATPs.

RATEADJV62

RATEADJV62 is a special utility program that produces a new set of emissions factors by linearly combining the emissions factors from multiple applications of POLFAC62 or RATEADJ62. There is a separate set of factors (that may be different for each pollutant-specific emissions type and vehicle type combination) for each of the input emissions factor data sets.

A practical application of RATEADJV62 is the application of emissions factor credits by individual vehicle class and/or individual pollutant. For example, for analyses requiring the effects of the Texas LED Fuel Program in MOBILE6 emissions factors, RATEADJV62 is used to apply reduction factors to only the NO_x emissions factors for diesel-fueled vehicle classes only.

IMPSUM6

The IMPSUM62 program applies the emissions factors obtained from POLFAC62 (or from one of the RATEADJ programs, when used) and VMT mixes (fractions of fleet VMT attributable to each vehicle classification in the study) to the time-of-day fleet VMT and speed estimates to calculate emissions by the specified time periods. The five primary inputs to IMPSUM62 are:

- MOBILE6 emissions factors developed with POLFAC62 (or a RATEADJ6, if used);
- link-based hourly VMT and speeds developed using a PREPIN2BW program. For each link, the following information is input to IMPSUM: county number, roadway type number, VMT on link, operational link-speed estimate, and link distance;
- VMT mix by time period, county and roadway type;

- X-Y coordinates (optional for gridded emissions); and
- data records associating the MOBILE6 drive cycle (Freeway, Arterial, Local, Ramp) emissions factors (or percentages thereof) to specific travel model functional classifications. These MOBILE6 drive cycle emissions factor percentages (valid from zero to 100) must sum to 100 percent for each travel model functional classification.

Using these input data, the VMT for each link is stratified by MOBILE6 drive cycle and the 28 vehicle types. The MOBILE6 emissions factors are matched to link VMT by drive cycle, speed, and vehicle type and are interpolated (for the speed that falls between the 14 MOBILE6 speeds, see the MOBILE6 interpolation methodology below) and multiplied by the link VMT to estimate the mobile source emissions for that link. Emissions factors for 65 mph are used for links with speeds greater than 65 mph and emissions factors for 2.5 mph are used for links with speeds lower than 2.5 mph. The emissions for the county and emissions type are reported by both roadway type and vehicle type for each of the subject time periods. A data set is produced for subsequent input to the SUMALL62 program. Also, link emissions may be written by county at the pollutant-specific emissions type sub-component level and 28 vehicle types level.

A tab-delimited output is optionally produced. This output includes all 28 vehicle types (or eight vehicle types in the compressed format) across a single output line. Each field in the output is separated by a tab character.

Example Emissions Factor Interpolation

To calculate emissions factors for average operational speeds that fall between two of the 14 MOBILE6 speed bin speeds, MOBILE6 interpolates each emissions factor using a factor developed from the inverse link speed and the inverse high and low bounding speed bin speeds (Section 5.3.4, MOBILE6 User's Guide, January 2002).

Using the MOBILE6 emissions factors tabulated by the 14 speeds, the IMPSUM6 program uses the MOBILE6 method to interpolate emissions factors as shown in the following example. This example interpolates an emissions factor corresponding to an average speed of 41.2 mph.

The interpolated emissions factor (EF_{Interp}) is expressed as:

$$EF_{\text{Interp}} = EF_{\text{LowSpeed}} - FAC_{\text{Interp}} \times (EF_{\text{LowSpeed}} - EF_{\text{HighSpeed}})$$

Where:

EF_{LowSpeed} = emission factor (EF) corresponding to tabulated speed below the average link speed:

$EF_{\text{HighSpeed}}$ = EF corresponding to tabulated speed above the average link speed; and

$$FAC_{Interp} = \left(\frac{1}{Speed_{link}} - \frac{1}{Speed_{low}} \right) \bigg/ \left(\frac{1}{Speed_{high}} - \frac{1}{Speed_{low}} \right).$$

Given that:

$$\begin{aligned} EF_{LowSpeed} &= 0.7413 \text{ g/mi;} \\ EF_{HighSpeed} &= 0.7274 \text{ g/mi;} \\ Speed_{link} &= 41.2 \text{ mph;} \\ Speed_{low} &= 40 \text{ mph;} \text{ and} \\ Speed_{high} &= 45 \text{ mph.} \end{aligned}$$

$$FAC_{Interp} = \left(\frac{1}{41.2mph} - \frac{1}{40mph} \right) \bigg/ \left(\frac{1}{45mph} - \frac{1}{40mph} \right) = \frac{-0.00073}{-0.00278} = 0.26214,$$

$$\begin{aligned} EF_{Interp} &= 0.7413 \text{ g/mi} - (0.26214) \times (0.7413 \text{ g/mi} - 0.7274 \text{ g/mi}) \\ &= 0.7377 \text{ g/mi} \end{aligned}$$

SUMALL6

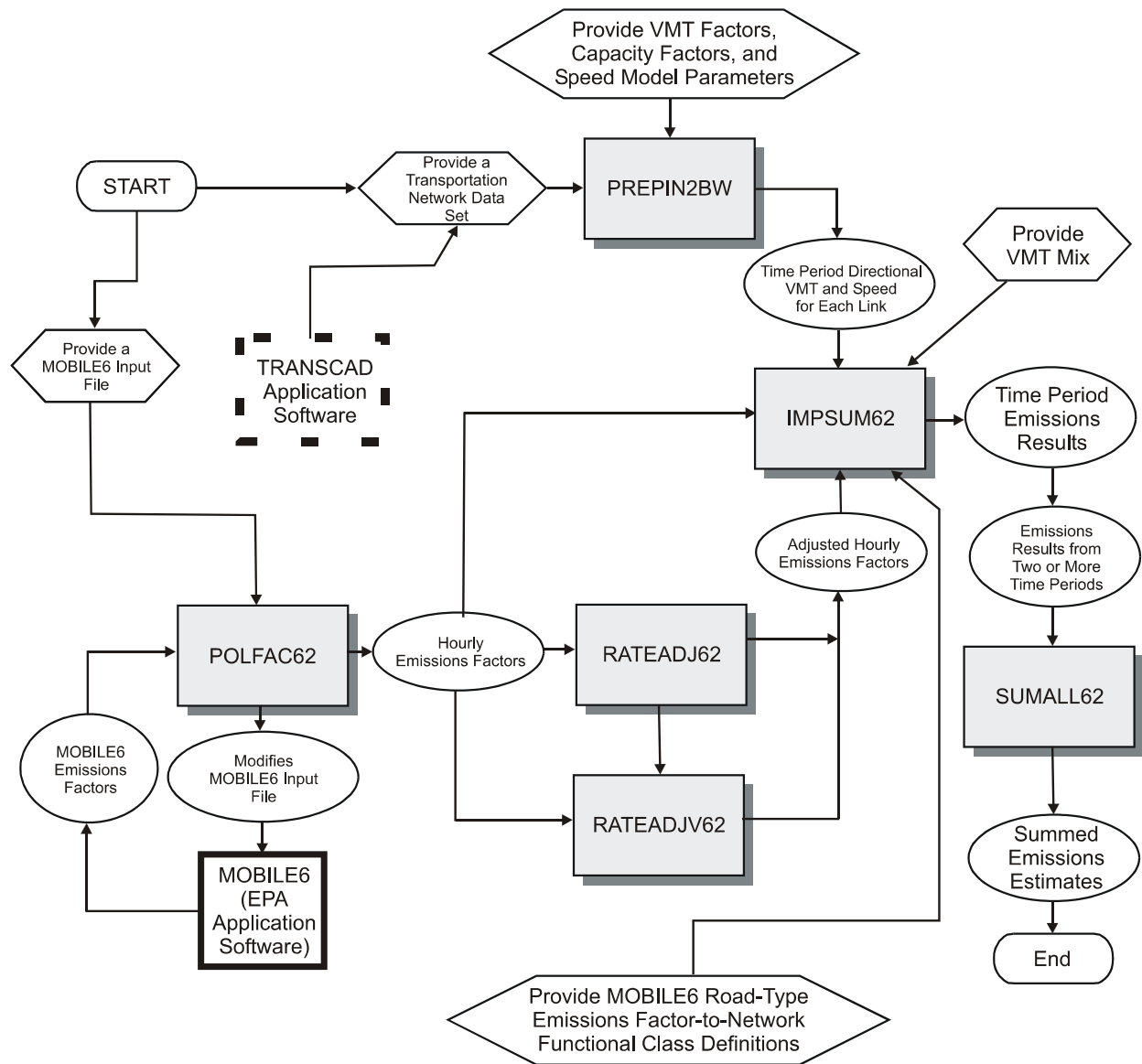
The SUMALL62 program is used to sum the emissions estimates for the time-of-day periods (e.g., 24 periods in the case of hourly analyses) to develop 24-hour emissions estimates. The emissions by pollutant type are reported by roadway type and 28 vehicle types (or optionally condensed to eight vehicle types).

A tab-delimited output is optionally produced. This output includes all 28 vehicle types (or eight vehicle types in the compressed format) across a single output line. Each field in the output is separated by a tab character.

The overall emissions estimate process flow is shown in the diagram below.

General Process Flow

Travel Demand Model Network Link-Based Hourly MOBILE6
Emissions Estimates with Texas Mobile Source Emissions Software



APPENDIX C
HOURLY TIME PERIOD VOLUME FACTORS

Weekday HGA Hourly Time Period Volume Factors
Freeways, Interstate

	Hour	CBD and Urban	Urban Fringe	Suburban	Rural
AM Peak	06:00	0.302055914	0.225632139	0.324597644	0.322400903
	07:00	0.391873901	0.456962542	0.358319391	0.359297162
	08:00	0.306070185	0.317405319	0.317082966	0.318301935
Mid-Day	09:00	0.158978411	0.140704491	0.152370360	0.159575180
	10:00	0.157050538	0.152643762	0.157726685	0.157032997
	11:00	0.165865452	0.168161125	0.165206547	0.162696432
	12:00	0.165685682	0.171929802	0.168822374	0.165763594
	13:00	0.170973392	0.177241611	0.174393200	0.171127945
	14:00	0.181446526	0.189319210	0.181480834	0.183803853
PM Peak	15:00	0.239373748	0.230505625	0.240582574	0.228155595
	16:00	0.271320441	0.271091032	0.254713427	0.254734230
	17:00	0.284788273	0.295613115	0.264894118	0.274629456
	18:00	0.204517538	0.202790228	0.239809882	0.242480719
Overnight	19:00	0.203863566	0.224047230	0.207782628	0.219489308
	20:00	0.161840473	0.182633853	0.164377778	0.164340464
	21:00	0.146819307	0.157694255	0.144263436	0.139186685
	22:00	0.126333231	0.134805356	0.115186163	0.107246956
	23:00	0.087673161	0.097483633	0.082998298	0.068630074
	00:00	0.049374812	0.048218183	0.049417020	0.037755605
	01:00	0.031572310	0.029167641	0.035011579	0.025375902
	02:00	0.028732316	0.025110084	0.031269852	0.022855537
	03:00	0.023482484	0.018397827	0.027876479	0.023666951
	04:00	0.033864833	0.022801225	0.039290180	0.044437291
	05:00	0.106443506	0.059640713	0.102526587	0.147015226

Weekday HGA Hourly Time Period Volume Factors
Arterials, Major Collectors

	Hour	CBD and Urban	Urban Fringe	Suburban	Rural
AM Peak	06:00	0.242861810	0.240506246	0.359462008	0.322400903
	07:00	0.395512755	0.386812073	0.380406843	0.359297162
	08:00	0.361625435	0.372681681	0.260131149	0.318301935
Mid-Day	09:00	0.154046951	0.140688905	0.159906308	0.159575180
	10:00	0.146773744	0.130783258	0.155516686	0.157032997
	11:00	0.169958745	0.165747780	0.164081480	0.162696432
	12:00	0.177038157	0.184755749	0.165532402	0.165763594
	13:00	0.171929000	0.186493743	0.168946926	0.171127945
	14:00	0.180253402	0.191530565	0.186016198	0.183803853
PM Peak	15:00	0.236708196	0.228844435	0.224988384	0.228155595
	16:00	0.272666422	0.258867808	0.268548642	0.254734230
	17:00	0.278413548	0.276744346	0.284933411	0.274629456
	18:00	0.212211834	0.235543411	0.221529563	0.242480719
Overnight	19:00	0.228914550	0.234232509	0.209361757	0.219489308
	20:00	0.178506543	0.193810969	0.160667124	0.164340464
	21:00	0.158917116	0.164785465	0.133880558	0.139186685
	22:00	0.132517321	0.123066744	0.098643335	0.107246956
	23:00	0.088185784	0.082027084	0.064052138	0.068630074
	00:00	0.045501668	0.046750737	0.034344181	0.037755605
	01:00	0.029894791	0.030065860	0.021228790	0.025375902
	02:00	0.025111624	0.026657496	0.016184044	0.022855537
	03:00	0.016284321	0.017006995	0.018511658	0.023666951
	04:00	0.021796254	0.021760422	0.053530375	0.044437291
	05:00	0.074370028	0.059835719	0.189596040	0.147015226

**Weekday HGA Hourly Time Period Volume Factors
Collectors, Locals**

	Hour	CBD and Urban	Urban Fringe	Suburban	Rural
AM Peak	06:00	0.268323895	0.268323895	0.268323895	0.332178880
	07:00	0.391369115	0.391369115	0.391369115	0.391796017
	08:00	0.340306990	0.340306990	0.340306990	0.276025103
Mid-Day	09:00	0.145691334	0.145691334	0.145691334	0.169614239
	10:00	0.141057850	0.141057850	0.141057850	0.163719094
	11:00	0.151990562	0.151990562	0.151990562	0.150472611
	12:00	0.168267255	0.168267255	0.168267255	0.148227195
	13:00	0.199352059	0.199352059	0.199352059	0.162689017
	14:00	0.193640940	0.193640940	0.193640940	0.205277844
PM Peak	15:00	0.219198029	0.219198029	0.219198029	0.200150392
	16:00	0.248822411	0.248822411	0.248822411	0.265447509
	17:00	0.282155142	0.282155142	0.282155142	0.299180856
	18:00	0.249824419	0.249824419	0.249824419	0.235221244
Overnight	19:00	0.271429147	0.271429147	0.271429147	0.230213047
	20:00	0.203102383	0.203102383	0.203102383	0.164065915
	21:00	0.150354742	0.150354742	0.150354742	0.134619139
	22:00	0.101488442	0.101488442	0.101488442	0.100685369
	23:00	0.046737393	0.046737393	0.046737393	0.053127879
	00:00	0.025049411	0.025049411	0.025049411	0.034570785
	01:00	0.017421196	0.017421196	0.017421196	0.024727294
	02:00	0.017353968	0.017353968	0.017353968	0.023629956
	03:00	0.018940566	0.018940566	0.018940566	0.024852837
	04:00	0.037652555	0.037652555	0.037652555	0.046757740
	05:00	0.110470196	0.110470196	0.110470196	0.162750039

Friday HGA Hourly Time Period Volume Factors
Freeways, Interstate

	Hour	CBD and Urban	Urban Fringe	Suburban	Rural
AM Peak	06:00	0.297131911	0.223883714	0.315342382	0.321128804
	07:00	0.394236840	0.451744674	0.359900816	0.359431094
	08:00	0.308631249	0.324371612	0.324756802	0.319440102
Mid-Day	09:00	0.151885595	0.131565910	0.143100799	0.147112900
	10:00	0.155020667	0.150129144	0.155806465	0.153781341
	11:00	0.165688412	0.167140769	0.164658623	0.163917121
	12:00	0.170092079	0.174827157	0.170684271	0.171089848
	13:00	0.172595888	0.180644137	0.179024444	0.177207023
	14:00	0.184717358	0.195692883	0.186725398	0.186891768
PM Peak	15:00	0.250312361	0.238352884	0.247168193	0.231656829
	16:00	0.274476752	0.268979235	0.251998134	0.251802146
	17:00	0.271549078	0.280666802	0.256950448	0.267068852
	18:00	0.203661809	0.212001079	0.243883226	0.249472173
Overnight	19:00	0.204212165	0.225567348	0.215469826	0.234794832
	20:00	0.163222524	0.185730905	0.170905018	0.176599484
	21:00	0.144546826	0.162711820	0.146774509	0.144376227
	22:00	0.129709686	0.134269438	0.118580837	0.112070283
	23:00	0.102397235	0.117584664	0.103509302	0.082170543
	00:00	0.048778554	0.042398399	0.045967609	0.037097674
	01:00	0.031355981	0.025747842	0.031251552	0.023714730
	02:00	0.028961539	0.023117457	0.027146346	0.019518347
	03:00	0.022593449	0.014760101	0.024038776	0.019477004
	04:00	0.030573363	0.019413531	0.033273576	0.035133848
	05:00	0.093648678	0.048698495	0.083082649	0.115047029

Friday HGA Hourly Time Period Volume Factors
Arterials, Major Collectors

	Hour	CBD and Urban	Urban Fringe	Suburban	Rural
AM Peak	06:00	0.235534471	0.245972563	0.353278084	0.321128804
	07:00	0.397641106	0.368797415	0.383437805	0.359431094
	08:00	0.366824423	0.385230022	0.263284111	0.319440102
Mid-Day	09:00	0.147016673	0.134035817	0.145777782	0.147112900
	10:00	0.149636042	0.146320837	0.155312524	0.153781341
	11:00	0.173491308	0.167846400	0.165351204	0.163917121
	12:00	0.180594538	0.183970842	0.168795325	0.171089848
	13:00	0.175412558	0.185555095	0.173527655	0.177207023
	14:00	0.173848882	0.182271009	0.191235510	0.186891768
PM Peak	15:00	0.252060518	0.235562992	0.233250661	0.231656829
	16:00	0.271763054	0.261421808	0.269978894	0.251802146
	17:00	0.263024060	0.270428250	0.271897813	0.267068852
	18:00	0.213152368	0.232586950	0.224872632	0.249472173
Overnight	19:00	0.209693450	0.224150550	0.215790771	0.234794832
	20:00	0.164523918	0.188068206	0.163948365	0.176599484
	21:00	0.152178356	0.162582658	0.140358412	0.144376227
	22:00	0.143014399	0.138132669	0.112374433	0.112070283
	23:00	0.115945193	0.111815346	0.084797637	0.082170543
	00:00	0.051444496	0.042100229	0.037161329	0.037097674
	01:00	0.033297723	0.027689747	0.021607713	0.023714730
	02:00	0.030380866	0.023148262	0.018846904	0.019518347
	03:00	0.018365072	0.013811605	0.017289750	0.019477004
	04:00	0.021374828	0.017438138	0.039591023	0.035133848
	05:00	0.059781700	0.051062592	0.148233663	0.115047029

**Friday HGA Hourly Time Period Volume Factors
Collectors, Locals**

	Hour	CBD and Urban	Urban Fringe	Suburban	Rural
AM Peak	06:00	0.248252236	0.248252236	0.248252236	0.309883735
	07:00	0.390755605	0.390755605	0.390755605	0.395197627
	08:00	0.360992159	0.360992159	0.360992159	0.294918638
Mid-Day	09:00	0.143587863	0.143587863	0.143587863	0.153460733
	10:00	0.148623871	0.148623871	0.148623871	0.157794209
	11:00	0.158205879	0.158205879	0.158205879	0.161225019
	12:00	0.186063567	0.186063567	0.186063567	0.165879008
	13:00	0.176804016	0.176804016	0.176804016	0.170670364
	14:00	0.186714804	0.186714804	0.186714804	0.190970667
PM Peak	15:00	0.233490515	0.233490515	0.233490515	0.225803004
	16:00	0.239308852	0.239308852	0.239308852	0.263357581
	17:00	0.265154297	0.265154297	0.265154297	0.268116520
	18:00	0.262046336	0.262046336	0.262046336	0.242722895
Overnight	19:00	0.273021852	0.273021852	0.273021852	0.240980422
	20:00	0.197259242	0.197259242	0.197259242	0.170723111
	21:00	0.142940348	0.142940348	0.142940348	0.127253819
	22:00	0.102001222	0.102001222	0.102001222	0.101406864
	23:00	0.068966082	0.068966082	0.068966082	0.073162137
	00:00	0.031086830	0.031086830	0.031086830	0.038531945
	01:00	0.021759548	0.021759548	0.021759548	0.030298733
	02:00	0.018494592	0.018494592	0.018494592	0.025245365
	03:00	0.019864560	0.019864560	0.019864560	0.025155126
	04:00	0.035090095	0.035090095	0.035090095	0.044045104
	05:00	0.089515629	0.089515629	0.089515629	0.123197372

**Saturday HGA Hourly Time Period Volume Factors
Freeways, Interstate**

	Hour	CBD and Urban	Urban Fringe	Suburban	Rural
AM Peak	06:00	0.268109383	0.272595665	0.248561171	0.256676195
	07:00	0.335639259	0.326493966	0.332514491	0.326379684
	08:00	0.396251358	0.400910369	0.418924338	0.416944122
Mid-Day	09:00	0.141881335	0.109105642	0.138860838	0.140115422
	10:00	0.157094066	0.144538058	0.160311921	0.163468429
	11:00	0.169826221	0.175150133	0.171240228	0.174544365
	12:00	0.179293716	0.186661227	0.177204017	0.175245241
	13:00	0.175814211	0.190920999	0.177975334	0.175047226
	14:00	0.176090451	0.193623941	0.174407663	0.171579317
PM Peak	15:00	0.262857141	0.251292942	0.256056699	0.253633313
	16:00	0.251928000	0.258083976	0.256013387	0.257040868
	17:00	0.248307149	0.254122246	0.252556355	0.254439856
	18:00	0.236907710	0.236500836	0.235373560	0.234885963
Overnight	19:00	0.171051909	0.199654652	0.192636098	0.207482860
	20:00	0.152069439	0.173289350	0.157857370	0.167130266
	21:00	0.145476107	0.155934039	0.143334013	0.152360430
	22:00	0.132176004	0.133707988	0.122093563	0.121990207
	23:00	0.105173601	0.109294499	0.100120811	0.092650344
	00:00	0.078759024	0.062285696	0.076096130	0.063036240
	01:00	0.053007905	0.042109928	0.049822502	0.040423113
	02:00	0.048308697	0.036658918	0.041272792	0.032466208
	03:00	0.030687522	0.023439341	0.029871940	0.025657199
	04:00	0.029666553	0.022331555	0.032291878	0.032470126
	05:00	0.053623240	0.041294034	0.054602902	0.064333006

Saturday HGA Hourly Time Period Volume Factors
Arterials, Major Collectors

	Hour	CBD and Urban	Urban Fringe	Suburban	Rural
AM Peak	06:00	0.212583118	0.189222972	0.303641691	0.256676195
	07:00	0.332081279	0.325851957	0.315939346	0.326379684
	08:00	0.455335603	0.484925072	0.380418963	0.416944122
Mid-Day	09:00	0.137136956	0.123892879	0.143450590	0.140115422
	10:00	0.156638485	0.146702463	0.161238842	0.163468429
	11:00	0.172838489	0.168945567	0.172510445	0.174544365
	12:00	0.179065247	0.184578831	0.173173803	0.175245241
	13:00	0.177554564	0.189368414	0.173241769	0.175047226
	14:00	0.176766260	0.186511846	0.176384551	0.171579317
PM Peak	15:00	0.265631077	0.263238522	0.248779946	0.253633313
	16:00	0.249548720	0.257061307	0.246898836	0.257040868
	17:00	0.242532899	0.245297543	0.263660960	0.254439856
	18:00	0.242287304	0.234402628	0.240660258	0.234885963
Overnight	19:00	0.176654879	0.191306371	0.196834267	0.207482860
	20:00	0.148245048	0.171522309	0.164075571	0.167130266
	21:00	0.141519211	0.152740621	0.145812322	0.152360430
	22:00	0.139339482	0.132316819	0.123066341	0.121990207
	23:00	0.119618581	0.110757220	0.093642641	0.092650344
	00:00	0.079456868	0.074863328	0.062317647	0.063036240
	01:00	0.056316388	0.053926365	0.042462254	0.040423113
	02:00	0.053263431	0.045859476	0.034010767	0.032466208
	03:00	0.028576477	0.023536978	0.022440692	0.025657199
	04:00	0.023453774	0.018066684	0.032530692	0.032470126
	05:00	0.033555861	0.025103830	0.082806805	0.064333006

**Saturday HGA Hourly Time Period Volume Factors
Collectors, Locals**

	Hour	CBD and Urban	Urban Fringe	Suburban	Rural
AM Peak	06:00	0.210087071	0.210087071	0.210087071	0.241936066
	07:00	0.314870519	0.314870519	0.314870519	0.330359400
	08:00	0.475042410	0.475042410	0.475042410	0.427704533
Mid-Day	09:00	0.145501909	0.145501909	0.145501909	0.152719021
	10:00	0.168577753	0.168577753	0.168577753	0.167874565
	11:00	0.174772675	0.174772675	0.174772675	0.176980527
	12:00	0.175292205	0.175292205	0.175292205	0.172726339
	13:00	0.171099058	0.171099058	0.171099058	0.166034418
	14:00	0.164756400	0.164756400	0.164756400	0.163665130
PM Peak	15:00	0.256302790	0.256302790	0.256302790	0.242371488
	16:00	0.246663563	0.246663563	0.246663563	0.255782935
	17:00	0.258415396	0.258415396	0.258415396	0.255647231
	18:00	0.238618251	0.238618251	0.238618251	0.246198345
Overnight	19:00	0.233217161	0.233217161	0.233217161	0.212267133
	20:00	0.193068465	0.193068465	0.193068465	0.167043760
	21:00	0.157101239	0.157101239	0.157101239	0.152836153
	22:00	0.115580826	0.115580826	0.115580826	0.112579279
	23:00	0.086480483	0.086480483	0.086480483	0.086732807
	00:00	0.058072217	0.058072217	0.058072217	0.065614251
	01:00	0.039775716	0.039775716	0.039775716	0.042308686
	02:00	0.024102476	0.024102476	0.024102476	0.032407499
	03:00	0.022917243	0.022917243	0.022917243	0.026884307
	04:00	0.023853826	0.023853826	0.023853826	0.035119391
	05:00	0.045830347	0.045830347	0.045830347	0.066206732

**Sunday HGA Hourly Time Period Volume Factors
Freeways, Interstate**

	Hour	CBD and Urban	Urban Fringe	Suburban	Rural
AM Peak	06:00	0.270650692	0.305443509	0.245145125	0.257235112
	07:00	0.318853329	0.312888758	0.318681698	0.313467190
	08:00	0.410495979	0.381667733	0.436173177	0.429297698
Mid-Day	09:00	0.119473515	0.083786651	0.104212824	0.105814252
	10:00	0.144050654	0.129360917	0.132181075	0.130693362
	11:00	0.157104331	0.173123620	0.158867089	0.159123892
	12:00	0.184486852	0.195127027	0.190787287	0.191776696
	13:00	0.195526632	0.208504316	0.203723193	0.205360811
	14:00	0.199358015	0.210097470	0.210228531	0.207230987
PM Peak	15:00	0.251304809	0.265397551	0.250575963	0.251090537
	16:00	0.245764900	0.257186407	0.255651622	0.254832324
	17:00	0.255617314	0.250085326	0.260465480	0.259151795
	18:00	0.247312977	0.227330715	0.233306935	0.234925344
Overnight	19:00	0.180508962	0.217030220	0.216669628	0.220749894
	20:00	0.164338459	0.182607268	0.179398041	0.177223663
	21:00	0.152579788	0.140551268	0.151496918	0.149379377
	22:00	0.124296175	0.097456171	0.114482705	0.107920047
	23:00	0.081810126	0.060576112	0.085483223	0.067961238
	00:00	0.086719418	0.090698145	0.074786040	0.069149150
	01:00	0.064156576	0.060947217	0.051343582	0.050734631
	02:00	0.058780917	0.053318071	0.042491491	0.070748975
	03:00	0.031274581	0.030793932	0.026915142	0.023489823
	04:00	0.022954590	0.025715647	0.023330081	0.023044814
	05:00	0.032580408	0.040305949	0.033603148	0.039598388

**Sunday HGA Hourly Time Period Volume Factors
Arterials, Major Collectors**

	Hour	CBD and Urban	Urban Fringe	Suburban	Rural
AM Peak	06:00	0.237771856	0.209537026	0.322375601	0.257235112
	07:00	0.318421728	0.311848127	0.292835442	0.313467190
	08:00	0.443806416	0.478614847	0.384788957	0.429297698
Mid-Day	09:00	0.110579005	0.105368333	0.108105532	0.105814252
	10:00	0.141015870	0.135447126	0.136473015	0.130693362
	11:00	0.162414627	0.162079160	0.164329190	0.159123892
	12:00	0.191797866	0.194703540	0.183764671	0.191776696
	13:00	0.194785551	0.202027218	0.198312395	0.205360811
	14:00	0.199407081	0.200374622	0.209015198	0.207230987
PM Peak	15:00	0.254878924	0.261357313	0.237304169	0.251090537
	16:00	0.252374074	0.259230869	0.245219456	0.254832324
	17:00	0.253096059	0.250175976	0.268299275	0.259151795
	18:00	0.239650942	0.229235842	0.249177100	0.234925344
Overnight	19:00	0.171852812	0.166032015	0.227880479	0.220749894
	20:00	0.156044328	0.154884220	0.189065952	0.177223663
	21:00	0.141553991	0.142532050	0.148016946	0.149379377
	22:00	0.121963943	0.112435601	0.109856412	0.107920047
	23:00	0.090433415	0.075560881	0.066423962	0.067961238
	00:00	0.095273816	0.105793671	0.068309644	0.069149150
	01:00	0.073022781	0.082832592	0.048282903	0.050734631
	02:00	0.068395383	0.074574005	0.037884403	0.070748975
	03:00	0.033487683	0.038361529	0.023191344	0.023489823
	04:00	0.022109033	0.023490226	0.024960760	0.023044814
	05:00	0.025862815	0.023503211	0.056127195	0.039598388

**Sunday HGA Hourly Time Period Volume Factors
Collectors, Locals**

	Hour	CBD and Urban	Urban Fringe	Suburban	Rural
AM Peak	06:00	0.185789757	0.185789757	0.185789757	0.251447327
	07:00	0.309437056	0.309437056	0.309437056	0.307790001
	08:00	0.504773187	0.504773187	0.504773187	0.440762671
Mid-Day	09:00	0.121971310	0.121971310	0.121971310	0.116055969
	10:00	0.132695544	0.132695544	0.132695544	0.132904325
	11:00	0.158371223	0.158371223	0.158371223	0.158857861
	12:00	0.198316691	0.198316691	0.198316691	0.188206959
	13:00	0.194771136	0.194771136	0.194771136	0.204791007
	14:00	0.193874097	0.193874097	0.193874097	0.199183878
PM Peak	15:00	0.246623018	0.246623018	0.246623018	0.247278418
	16:00	0.246871380	0.246871380	0.246871380	0.235632427
	17:00	0.263307852	0.263307852	0.263307852	0.269491221
	18:00	0.243197750	0.243197750	0.243197750	0.247597933
Overnight	19:00	0.263884591	0.263884591	0.263884591	0.251976111
	20:00	0.217267432	0.217267432	0.217267432	0.198233529
	21:00	0.151333883	0.151333883	0.151333883	0.157833037
	22:00	0.095099353	0.095099353	0.095099353	0.101295260
	23:00	0.050807035	0.050807035	0.050807035	0.059481896
	00:00	0.069964417	0.069964417	0.069964417	0.063468485
	01:00	0.047704380	0.047704380	0.047704380	0.044833854
	02:00	0.030871836	0.030871836	0.030871836	0.034848288
	03:00	0.021022415	0.021022415	0.021022415	0.023591138
	04:00	0.019157383	0.019157383	0.019157383	0.023518585
	05:00	0.032887275	0.032887275	0.032887275	0.040919818

APPENDIX D
CAPACITY FACTORS, SPEED FACTORS,
AND SPEED REDUCTION FACTORS

Capacity Factors

Time of Day Assignment	Capacity Factor ¹
AM Peak	0.3333333
Mid-Day	0.1666667
PM Peak	0.2500000
Overnight	0.0909091

Freeflow (Volume = 1) Speed Factors for Houston/Galveston Speed Model

Functional Group	Area Type				
	CBD	Urban	Urban Fringe	Suburban	Rural
Freeways, Interstates	1.186820	1.228426	1.257296	1.251342	1.163231
Principal Arterials	1.303939	0.915915	1.036486	1.186962	1.232585
Other Arterials, Major Collectors	1.362941	0.891892	0.902816	0.902816	1.285328
Collectors	1.026781	0.782401	0.780729	1.243300	1.268756
Locals	1.000000	1.000000	1.000000	1.000000	1.000000

¹ To obtain hourly capacities, a single capacity factor for each time-of-day assignment is used for all area types and function classes.

LOS E (V/C = 1.0) Speed Factors for Houston/Galveston Speed Model

Functional Group	Area Type				
	CBD	Urban	Urban Fringe	Suburban	Rural
Freeways, Interstates	0.746411	0.768691	0.766129	0.862558	0.769231
Principal Arterials	0.801293	0.678157	0.818155	0.927510	1.000952
Other Arterials, Major Collectors	0.892941	0.674991	0.697245	0.865193	1.077930
Collectors	0.647537	0.559686	0.618592	0.963669	1.084520
Locals	1.000000	1.000000	1.000000	1.000000	1.000000

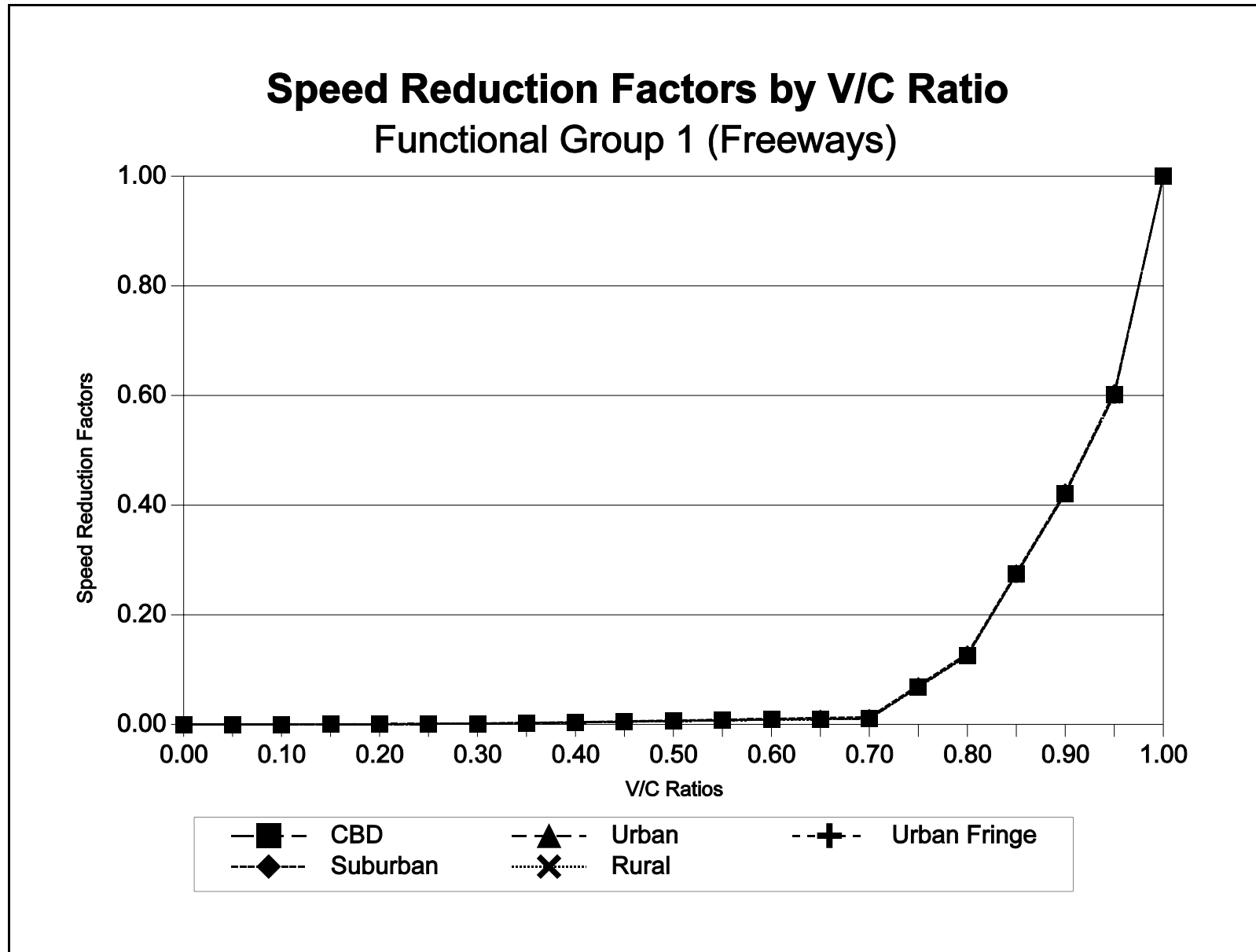


Figure 1. Freeway Speed Reduction Factors by V/C Ratio.

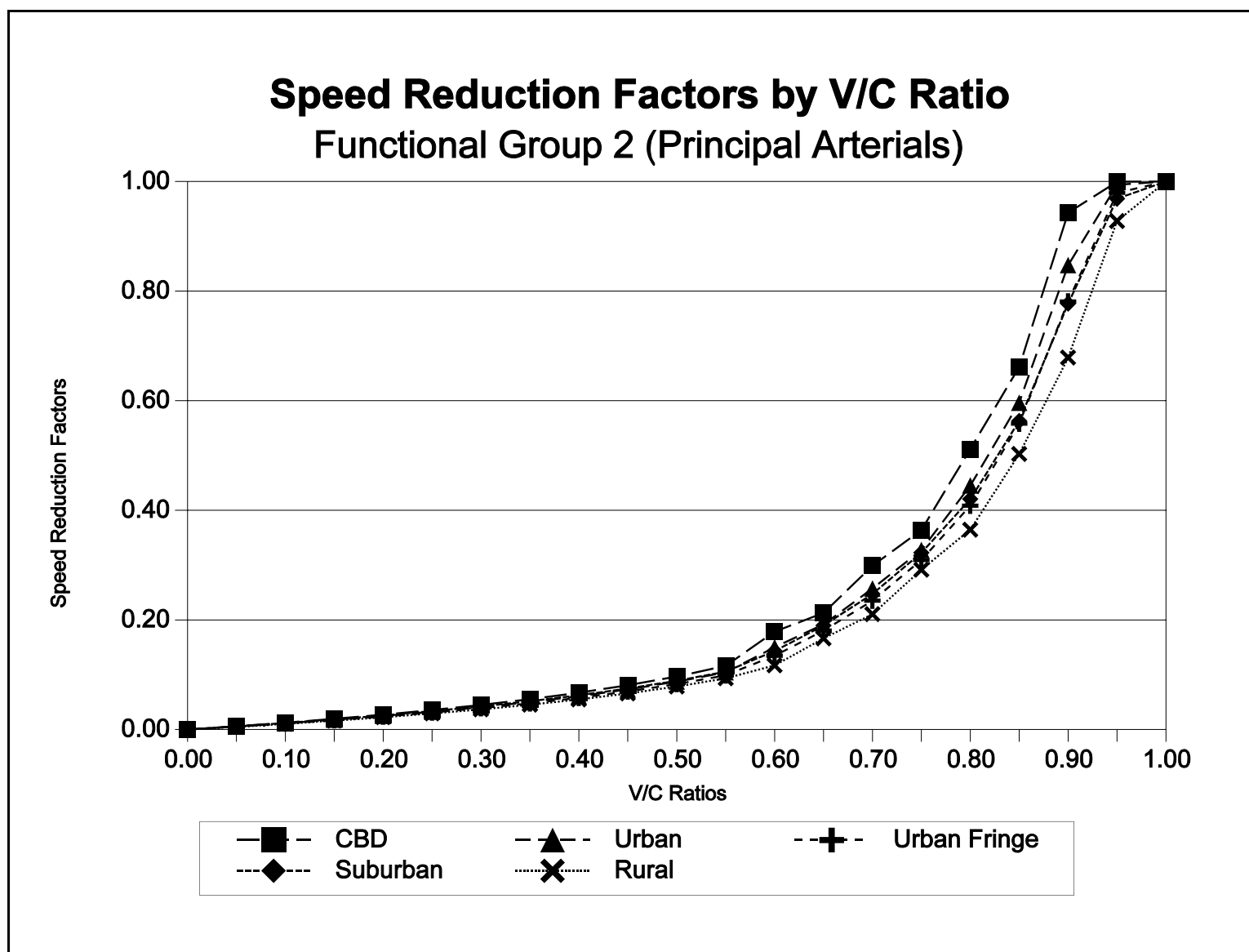


Figure 2. Principal Arterial Speed Reduction Factors by V/C Ratio.

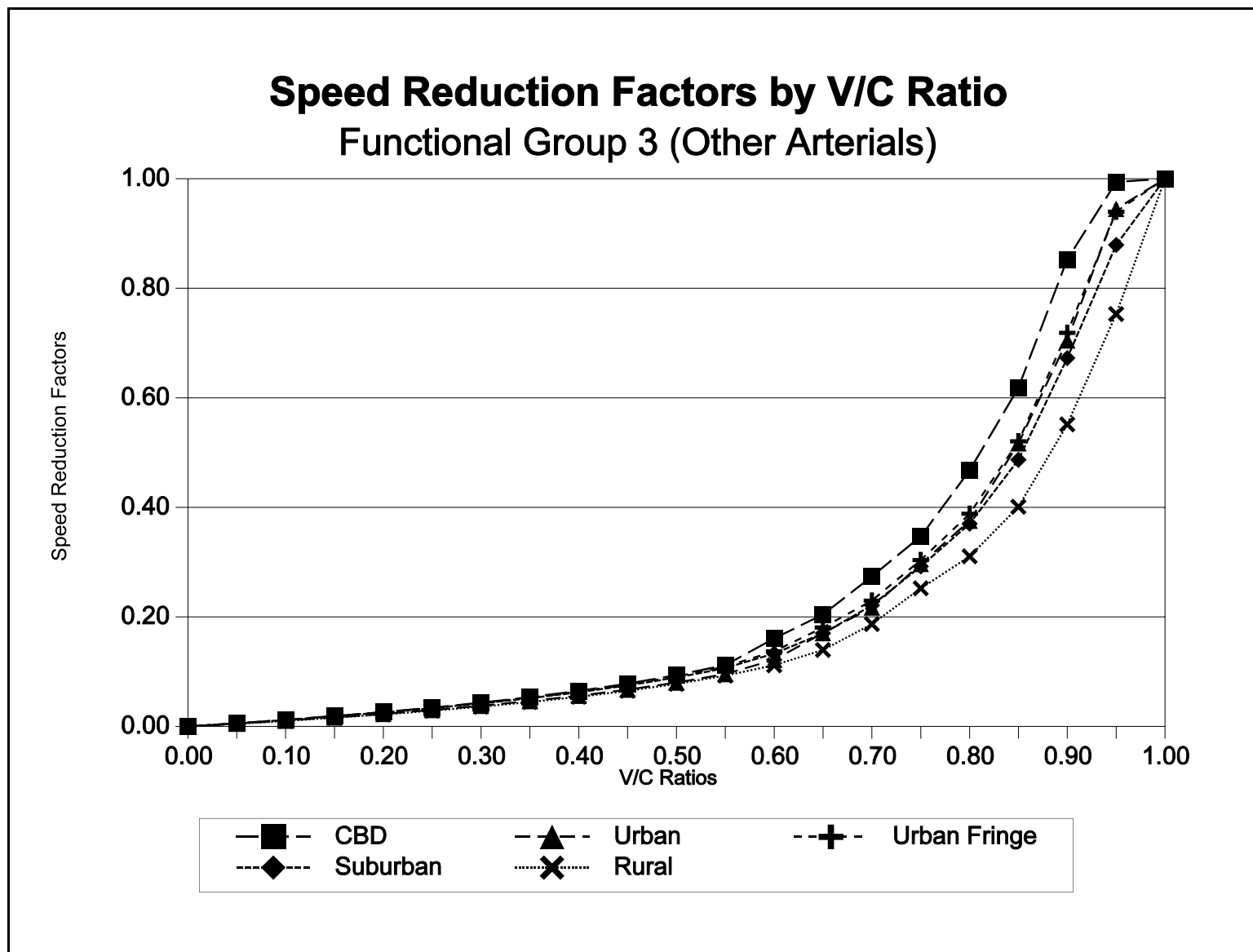


Figure 3. Other Arterial Speed Reduction Factors by V/C Ratio.

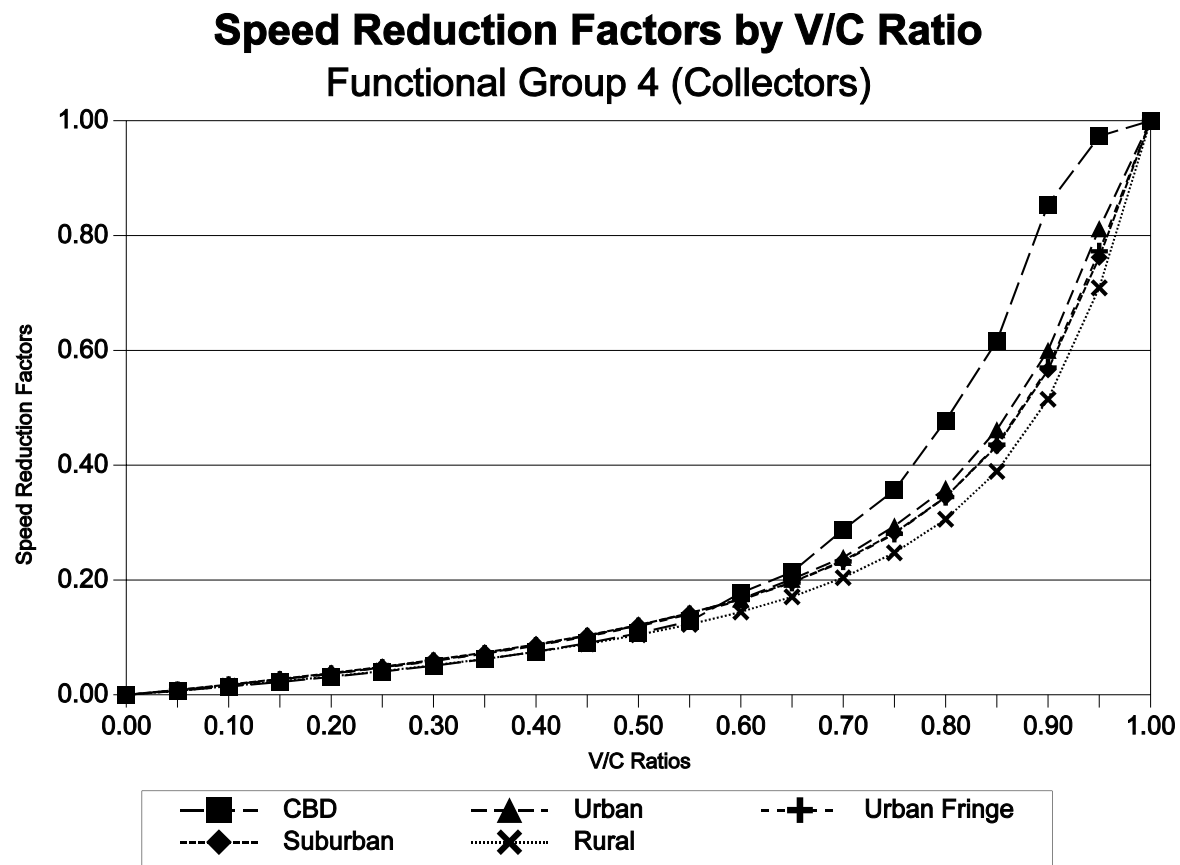


Figure 4. Collector Speed Reduction Factors by V/C Ratio.

APPENDIX E
HGA COUNTY AUGUST 2000 EPISODE DAY HOURLY CLIMATIC
INPUTS TO MOBILE6

HGA County 2000 Episode Day Climatic Inputs to MOBILE6

Central Daylight (Local) Time, Temperature (degrees F), Humidity (%), and Sunrise/sunset times rounded to nearest hour (calendar day hourly data input order: 6 a.m. to 12 a.m., 12 a.m. to 6 a.m.).

Friday, August 18

Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Friday, August 18

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 74.0 79.4 83.2 86.2 89.3 91.8 93.4 94.2 94.3 93.8 92.5 90.1 86.2 82.8 81.7 79.2 77.8 77.0 77.5 76.4 76.1 74.9 75.5 73.7

RELATIVE HUMIDITY: 97.0 84.5 72.0 61.0 52.0 45.5 38.5 33.0 35.5 37.5 40.0 47.0 64.5 77.5 79.5 87.5 92.0 93.0 97.0 97.0 97.0 98.5 97.0 97.0

BAROMETRIC PRES: 29.93

CHAM

* Chambers, Friday, August 18

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 73.7 73.9 78.3 83.3 86.3 88.8 91.6 94.0 94.8 95.5 94.3 92.9 90.4 87.1 84.0 82.7 81.6 79.8 80.2 78.8 77.8 76.8 75.0 74.4

RELATIVE HUMIDITY: 98.4 98.5 92.4 86.4 77.5 66.6 58.5 50.8 47.6 45.8 43.3 45.6 46.9 53.7 67.4 79.1 84.6 88.3 92.3 94.4 96.0 97.0 98.0 97.6

BAROMETRIC PRES: 29.92

FORT

* Fort Bend, Friday, August 18

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 74.9 75.4 80.0 84.1 87.1 90.3 92.7 94.9 96.5 97.6 97.9 98.0 95.4 91.8 88.0 84.7 82.3 80.7 80.1 79.0 77.9 76.9 76.1 75.5

RELATIVE HUMIDITY: 96.2 95.0 83.3 72.5 62.3 53.4 48.0 42.9 35.4 32.3 30.5 29.0 32.0 42.4 51.4 65.0 75.4 80.5 85.5 88.5 90.4 92.9 93.9 94.7

BAROMETRIC PRES: 29.92

GALV

* Galveston, Friday, August 18

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.1 79.4 81.7 84.1 85.9 87.9 88.6 88.9 89.0 90.8 89.1 88.2 87.4 86.1 85.3 84.9 84.6 84.4 84.3 83.8 83.4 83.2 81.8 80.3

RELATIVE HUMIDITY: 85.1 84.6 80.5 73.0 70.1 65.7 69.7 67.9 69.3 68.6 68.4 69.3 70.4 71.5 75.6 76.0 76.6 76.9 82.9 84.4 82.6 85.4 86.1 84.6

BAROMETRIC PRES: 29.92

HARR

* Harris, Friday, August 18

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.3 77.4 80.5 83.7 86.4 89.1 91.5 93.3 94.8 95.6 95.6 94.7 92.8
89.9 86.7 84.2 82.5 81.3 80.8 79.6 78.4 77.3 76.8 76.2

RELATIVE HUMIDITY: 96.9 90.9 81.2 71.7 62.1 53.1 46.6 40.9 36.5 35.7 35.9 38.2 41.6 49.6
59.6 70.6 79.0 83.7 88.2 91.6 94.2 96.1 96.9 97.1

BAROMETRIC PRES: 29.89

LIBE

* Liberty, Friday, August 18

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 71.2 71.5 76.4 81.2 84.5 87.7 90.6 93.2 94.8 95.7 95.3 94.2 92.4
88.3 84.3 82.1 80.3 78.2 79.2 77.6 76.7 75.2 73.2 72.3

RELATIVE HUMIDITY: 93.0 79.0 72.0 59.0 45.0 40.0 34.0 31.0 28.0 29.0 28.0 32.0 41.0 51.0
61.0 61.0 71.0 82.0 79.0 85.0 91.0 97.0 96.0 96.0

BAROMETRIC PRES: 29.68

MONT

* Montgomery, Friday, August 18

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 70.4 76.0 80.3 83.7 87.3 90.7 93.9 96.0 97.6 98.5 98.3 97.3 94.8
90.4 86.5 83.9 80.6 77.9 79.2 77.3 75.3 72.8 71.2 70.2

RELATIVE HUMIDITY: 93.0 79.0 72.0 59.0 45.0 40.0 34.0 31.0 28.0 29.0 28.0 32.0 41.0 51.0
61.0 61.0 71.0 82.0 79.0 85.0 91.0 97.0 96.0 96.0

BAROMETRIC PRES: 29.68

WALL

* Waller, Friday, August 18

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.3 79.4 78.3 84.4 88.5 91.9 94.6 96.9 98.6 100.1 100.6 100.7
99.7 96.4 91.9 88.6 85.5 82.6 82.8 81.5 80.4 79.4 79.9 79.8

RELATIVE HUMIDITY: 100.0 88.0 74.0 63.0 53.0 42.0 39.0 34.0 34.0 32.0 34.0 32.0 38.0 48.0
55.0 64.0 77.0 85.0 87.0 94.0 97.0 100.0 100.0 100.0

BAROMETRIC PRES: 29.79

Saturday, August 19
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Saturday, August 19

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.1 79.0 82.7 85.9 88.4 89.7 91.2 92.3 92.4 91.6 89.7 88.2 85.1
82.6 80.6 79.2 77.5 76.6 76.2 76.1 75.4 75.2 74.5 74.5

RELATIVE HUMIDITY: 95.0 83.5 72.0 61.0 52.5 50.0 46.5 44.0 45.5 49.0 55.0 56.5 67.5 75.5
81.5 85.0 90.5 92.5 95.5 97.0 97.0 97.0 97.0 97.0

BAROMETRIC PRES: 29.94

CHAM

* Chambers, Saturday, August 19

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 73.5 73.5 78.0 82.9 87.0 89.3 91.5 93.5 94.6 94.3 93.5 91.5 88.9
85.8 83.7 81.9 80.5 78.8 78.5 78.4 77.5 76.2 75.3 73.7

RELATIVE HUMIDITY: 95.9 95.3 90.3 82.0 70.2 63.6 57.8 51.5 54.0 53.5 57.3 56.5 58.6 66.6
78.7 84.0 85.8 89.2 90.4 91.8 93.1 94.0 94.2 95.0

BAROMETRIC PRES: 29.94

FORT

* Fort Bend, Saturday, August 19

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 74.6 74.8 79.8 84.2 87.0 89.1 91.4 94.6 96.3 97.7 98.0 96.6 93.8
90.0 86.2 83.4 81.2 79.5 79.6 79.0 78.5 77.5 76.6 75.6

RELATIVE HUMIDITY: 93.0 90.9 79.7 71.5 62.4 52.2 44.8 38.7 36.2 32.3 31.6 36.2 44.4 52.2
61.2 69.2 73.6 78.5 83.2 83.7 84.2 86.4 89.8 91.9

BAROMETRIC PRES: 29.93

GALV

* Galveston, Saturday, August 19

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.5 78.9 79.6 82.3 85.0 85.6 86.6 88.0 88.4 88.4 88.2 87.7 86.8
85.6 84.7 84.3 84.2 83.8 84.2 84.0 83.7 83.0 82.1 80.4

RELATIVE HUMIDITY: 86.3 91.4 85.5 73.9 69.7 69.6 68.7 67.9 69.2 68.3 68.4 70.3 74.7 77.0
78.6 75.6 79.9 79.0 76.1 75.2 77.2 79.6 80.6 81.2

BAROMETRIC PRES: 29.93

HARR

* Harris, Saturday, August 19

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.9 76.7 80.3 83.9 86.7 89.0 91.2 93.1 94.3 94.9 94.5 93.3 91.3
88.4 85.3 83.2 81.6 80.1 80.4 79.5 78.4 77.8 77.1 76.2

RELATIVE HUMIDITY: 93.7 89.2 79.3 67.9 60.0 51.3 43.9 39.4 39.7 38.4 41.9 47.6 52.7 60.3
69.6 76.7 78.7 84.6 86.1 88.9 91.0 91.7 93.6 95.0

BAROMETRIC PRES: 29.91

IBE

* Liberty, Saturday, August 19

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 72.4 72.3 76.3 81.4 85.3 88.4 90.9 93.0 94.4 94.9 95.1 93.7 91.3
87.9 84.1 81.7 79.5 77.7 77.0 76.4 75.1 74.5 73.9 72.9

RELATIVE HUMIDITY: 94.0 79.0 57.0 52.0 42.0 35.0 27.0 28.0 24.0 23.0 25.0 25.0 45.0 55.0
65.0 71.0 79.0 88.0 81.0 82.0 88.0 90.0 94.0 96.0

BAROMETRIC PRES: 29.69

MONT

* Montgomery, Saturday, August 19

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 72.4 76.4 81.1 85.1 88.2 91.4 94.4 95.8 98.7 98.3 98.4 97.8 94.5
90.8 86.2 83.1 80.5 77.5 76.2 76.8 76.0 75.4 73.7 71.4

RELATIVE HUMIDITY: 94.0 79.0 57.0 52.0 42.0 35.0 27.0 28.0 24.0 23.0 25.0 25.0 45.0 55.0
65.0 71.0 79.0 88.0 81.0 82.0 88.0 90.0 94.0 96.0

BAROMETRIC PRES: 29.69

WALL

* Waller, Saturday, August 19

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.3 77.4 77.9 84.6 88.8 91.9 94.8 96.3 98.8 100.1 100.7 100.5
99.5 95.5 90.6 87.2 84.4 81.9 79.8 78.2 77.5 77.5 78.3 78.3

RELATIVE HUMIDITY: 96.0 88.0 74.0 53.0 48.0 41.0 35.0 32.0 30.0 29.0 30.0 44.0 50.0 57.0
65.0 71.0 79.0 90.0 91.0 94.0 94.0 96.0 97.0 100.0

BAROMETRIC PRES: 29.80

Sunday, August 20
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Sunday, August 20

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.5 81.7 84.0 87.1 89.6 90.8 93.1 95.2 94.0 93.3 91.1 89.0 86.2
83.6 81.9 80.1 79.7 77.9 76.0 76.3 75.9 75.2 75.3 75.3

RELATIVE HUMIDITY: 95.5 79.0 73.5 63.0 53.0 49.5 41.5 41.5 48.5 48.5 55.0 59.0 66.5 74.5
81.0 89.5 90.5 94.0 93.5 93.0 93.5 97.0 95.0 97.0

BAROMETRIC PRES: 29.91

CHAM

* Chambers, Sunday, August 20

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 73.8 74.1 77.9 82.7 86.0 88.8 90.5 92.6 94.7 94.7 93.7 92.2 90.1
87.3 85.1 83.2 81.7 80.7 77.9 77.1 76.8 75.7 75.2 74.9

RELATIVE HUMIDITY: 96.2 95.4 91.7 86.6 80.4 70.5 64.4 56.2 53.3 55.6 60.5 65.2 68.2 73.6
78.5 84.0 89.5 91.8 91.5 93.5 95.4 94.9 95.0 95.6

BAROMETRIC PRES: 29.91

FORT

* Fort Bend, Sunday, August 20

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.5 75.8 79.9 84.0 86.8 89.4 92.4 94.0 96.1 98.2 99.2 98.6 95.6
91.1 87.6 85.2 83.1 81.4 78.4 77.4 76.5 76.0 75.8 75.9

RELATIVE HUMIDITY: 91.0 90.8 80.2 74.6 66.5 56.3 47.9 41.4 36.7 33.6 32.5 35.2 46.8 54.2
60.1 67.3 74.1 77.6 82.0 83.2 83.3 85.9 88.6 89.3

BAROMETRIC PRES: 29.90

GALV

* Galveston, Sunday, August 20

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 80.5 79.6 80.4 82.5 84.8 86.3 86.7 86.9 87.8 88.1 88.3 87.8 87.1
85.9 85.2 84.9 84.7 84.5 83.5 83.4 83.2 82.9 82.8 82.0

RELATIVE HUMIDITY: 86.2 85.1 82.8 84.4 78.3 75.5 75.0 75.6 75.4 73.0 74.0 76.2 78.6 79.6
78.7 78.9 82.5 84.2 76.8 79.3 81.2 82.3 83.9 85.0

BAROMETRIC PRES: 29.90

HARR

* Harris, Sunday, August 20

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.1 76.9 80.0 83.7 86.4 88.9 91.3 92.9 94.5 95.2 95.3 94.0 92.0 89.0 86.1 84.2 82.9 81.7 78.9 78.1 77.4 76.9 76.6 76.1

RELATIVE HUMIDITY: 92.6 87.8 80.6 73.0 66.2 57.3 50.9 44.2 42.9 44.4 44.8 51.3 60.2 65.9 71.0 75.4 79.6 84.7 88.3 90.3 92.0 92.4 93.6 93.5

BAROMETRIC PRES: 29.88

LIBE

* Liberty, Sunday, August 20

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 72.2 71.8 76.4 81.2 85.1 87.9 90.1 92.3 93.9 95.3 95.1 93.9 92.0 89.0 85.6 83.4 81.6 79.9 76.7 75.8 74.8 73.8 73.1 73.2

RELATIVE HUMIDITY: 93.0 79.0 70.0 59.0 50.0 44.0 42.0 34.0 31.0 29.0 31.0 34.0 46.0 63.0 67.0 74.0 77.0 82.0 94.0 93.0 96.0 96.0 93.0 97.0

BAROMETRIC PRES: 29.67

MONT

* Montgomery, Sunday, August 20

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 70.9 74.7 80.1 84.2 87.5 90.5 91.7 95.5 96.5 97.5 98.0 96.9 95.1 91.7 88.3 84.8 83.2 80.4 75.6 73.6 72.4 71.8 71.0 70.5

RELATIVE HUMIDITY: 93.0 79.0 70.0 59.0 50.0 44.0 42.0 34.0 31.0 29.0 31.0 34.0 46.0 63.0 67.0 74.0 77.0 82.0 94.0 93.0 96.0 96.0 93.0 97.0

BAROMETRIC PRES: 29.67

WALL

* Waller, Sunday, August 20

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.8 76.6 78.2 85.4 88.5 92.3 93.6 95.5 98.3 99.8 100.6 101.0 100.4 96.8 91.5 88.5 86.1 83.7 79.5 77.7 76.3 77.2 78.3 78.2

RELATIVE HUMIDITY: 94.0 85.0 74.0 61.0 54.0 49.0 41.0 39.0 35.0 33.0 33.0 37.0 56.0 61.0 65.0 69.0 77.0 88.0 93.0 97.0 97.0 97.0 100.0 97.0

BAROMETRIC PRES: 29.77

Monday, August 21
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Monday, August 21

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.3 81.7 84.7 86.8 89.5 91.3 91.7 93.0 93.3 92.9 91.0 88.2 85.9
83.7 82.1 81.9 80.7 79.9 77.3 77.9 76.9 76.4 76.3 75.9

RELATIVE HUMIDITY: 97.0 82.0 71.0 64.5 55.0 48.0 53.0 45.5 43.0 43.0 51.0 61.0 68.5 77.0
83.5 83.0 88.0 91.0 95.0 95.0 97.0 98.0 97.0 98.0

BAROMETRIC PRES: 29.93

CHAM

* Chambers, Monday, August 21

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.3 77.0 79.5 82.7 86.3 89.2 91.3 93.5 95.1 95.4 95.2 91.6 89.8
87.0 85.4 84.4 83.9 82.2 80.1 79.6 79.1 78.7 78.5 77.7

RELATIVE HUMIDITY: 97.8 96.9 92.3 86.8 74.3 65.0 61.1 58.8 50.7 50.3 52.2 56.5 60.4 68.2
78.2 85.5 89.6 90.8 92.3 93.2 93.9 95.4 96.5 97.1

BAROMETRIC PRES: 29.93

FORT

* Fort Bend, Monday, August 21

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.6 77.1 81.1 85.2 88.2 91.0 93.9 94.8 96.4 96.9 97.6 96.6 95.7
91.8 87.3 85.0 83.4 82.3 80.4 79.4 78.5 78.0 77.7 77.3

RELATIVE HUMIDITY: 92.8 90.3 81.4 72.0 63.4 55.5 48.3 44.4 40.1 37.2 29.8 30.9 34.6 49.9
61.7 68.6 74.7 79.8 80.2 84.1 86.9 88.4 90.3 91.6

BAROMETRIC PRES: 29.91

GALV

* Galveston, Monday, August 21

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 80.8 79.2 80.7 82.4 84.2 86.1 86.7 87.5 88.0 88.1 88.0 87.9 87.2
86.0 85.4 85.2 85.0 84.8 84.1 83.9 83.7 83.6 83.2 82.6

RELATIVE HUMIDITY: 88.0 88.4 88.6 83.6 76.5 74.5 74.0 68.9 71.4 72.8 72.0 72.9 79.6 81.3
81.0 82.0 83.8 84.8 84.1 84.3 85.2 85.6 87.0 86.5

BAROMETRIC PRES: 29.91

HARR

* Harris, Monday, August 21

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.9 78.7 81.4 84.3 87.1 89.5 91.7 93.4 94.7 95.3 95.4 94.1 91.6
88.7 86.2 84.7 83.6 82.9 80.9 80.1 79.3 78.8 78.4 77.8

RELATIVE HUMIDITY: 95.7 89.5 80.9 71.9 60.8 53.5 48.8 44.3 41.1 40.6 40.3 44.2 48.8 56.9
67.0 74.4 80.4 83.9 86.5 89.8 91.3 93.0 94.1 94.9

BAROMETRIC PRES: 29.89

LIBE

* Liberty, Monday, August 21

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 74.2 74.4 77.8 82.0 85.1 88.3 91.2 93.3 94.7 94.8 94.7 93.0 91.4
88.6 85.8 84.0 82.3 80.1 78.7 77.9 76.9 76.2 75.5 74.8

RELATIVE HUMIDITY: 94.0 85.0 72.0 59.0 49.0 42.0 35.0 33.0 33.0 29.0 33.0 34.0 46.0 52.0
53.0 61.0 67.0 71.0 88.0 88.0 94.0 94.0 97.0 97.0

BAROMETRIC PRES: 29.69

MONT

* Montgomery, Monday, August 21

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 72.6 75.8 80.9 85.3 88.3 91.2 94.6 96.8 97.3 99.1 98.5 96.7 93.9
90.9 87.6 84.3 81.7 79.4 78.5 77.0 74.5 73.8 72.2 71.7

RELATIVE HUMIDITY: 94.0 85.0 72.0 59.0 49.0 42.0 35.0 33.0 33.0 29.0 33.0 34.0 46.0 52.0
53.0 61.0 67.0 71.0 88.0 88.0 94.0 94.0 97.0 97.0

BAROMETRIC PRES: 29.69

WALL

* Waller, Monday, August 21

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.9 78.6 78.9 84.4 88.2 92.1 94.4 97.3 99.2 100.4 101.0 100.3
99.3 96.1 90.2 87.0 84.8 83.6 82.0 80.5 78.4 77.7 78.4 78.4

RELATIVE HUMIDITY: 97.0 85.0 74.0 63.0 50.0 44.0 43.0 36.0 34.0 34.0 36.0 40.0 45.0 48.0
55.0 67.0 77.0 82.0 91.0 94.0 94.0 97.0 100.0

BAROMETRIC PRES: 29.79

Tuesday, August 22
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Tuesday, August 22

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.2 80.6 81.8 81.2 83.2 85.7 88.5 89.4 89.9 89.8 88.8 87.5 85.3
83.5 81.5 80.6 79.7 78.7 78.5 77.8 78.1 77.8 77.0 77.3

RELATIVE HUMIDITY: 93.5 87.0 78.5 79.0 73.0 69.0 60.5 60.0 59.0 55.5 60.5 62.0 71.0 78.0
85.0 86.5 91.0 94.0 95.0 95.5 97.0 97.0 97.0 97.0

BAROMETRIC PRES: 29.97

CHAM

* Chambers, Tuesday, August 22

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.9 77.6 80.7 84.7 85.6 85.7 84.0 81.3 83.4 86.3 88.9 89.0 87.1
85.2 82.9 81.8 80.9 79.8 81.0 80.6 79.7 79.1 77.9 77.3

RELATIVE HUMIDITY: 96.1 95.1 92.2 88.0 84.8 84.5 81.2 79.9 74.8 75.0 70.6 67.5 69.9 74.6
80.4 84.5 87.6 89.7 91.6 92.3 93.2 94.5 95.7 96.1

BAROMETRIC PRES: 29.97

FORT

* Fort Bend, Tuesday, August 22

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.4 78.8 82.5 85.1 87.3 86.4 80.2 83.2 87.9 89.7 89.8 89.2 88.7
87.4 85.7 83.9 82.5 81.3 81.2 80.4 79.5 78.9 78.2 77.7

RELATIVE HUMIDITY: 92.4 88.4 80.2 77.1 68.4 70.6 77.8 70.0 64.0 60.7 58.1 54.2 54.0 60.6
65.5 71.2 78.0 81.6 83.2 85.2 87.5 89.4 90.4 91.6

BAROMETRIC PRES: 29.96

GALV

* Galveston, Tuesday, August 22

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 83.7 83.1 84.1 84.9 85.3 85.5 85.4 85.1 85.6 86.2 86.4 86.1 85.8
85.4 85.1 84.7 84.8 84.9 84.6 84.6 84.3 84.3 84.1 84.0

RELATIVE HUMIDITY: 81.5 79.8 77.3 73.8 70.3 69.6 71.3 75.1 73.5 73.0 76.0 75.4 74.8 77.3
78.1 80.3 79.0 80.4 82.9 84.0 86.2 84.0 81.9 82.5

BAROMETRIC PRES: 29.96

HARR

* Harris, Tuesday, August 22

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.1 79.8 82.0 84.4 85.4 84.6 83.0 83.6 85.6 87.0 88.2 88.7 88.1
86.3 84.7 83.6 82.9 82.0 82.0 81.5 80.8 80.3 79.7 79.3

RELATIVE HUMIDITY: 90.5 85.7 80.1 75.0 71.9 71.8 71.2 73.3 68.9 65.9 61.1 59.9 62.3 69.4
74.8 78.8 82.3 86.9 86.5 87.9 90.2 92.2 92.6 92.2

BAROMETRIC PRES: 29.94

LIBE

* Liberty, Tuesday, August 22

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 74.0 75.1 78.9 83.2 85.4 85.0 81.5 78.8 78.7 81.5 84.2 85.8 85.2
83.4 80.8 79.5 79.1 77.5 78.4 77.1 76.4 75.4 74.6 74.4

RELATIVE HUMIDITY: 85.0 77.0 72.0 65.0 59.0 52.0 87.0 91.0 91.0 82.0 77.0 79.0 90.0 96.0
90.0 96.0 100.0 100.0 77.0 79.0 84.0 87.0 90.0 90.0

BAROMETRIC PRES: 29.74

MONT

* Montgomery, Tuesday, August 22

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 73.3 77.3 81.4 84.4 86.5 88.9 80.6 77.3 74.0 77.1 80.2 82.1 81.1
79.8 78.4 76.6 76.7 75.8 78.0 76.7 74.7 73.8 72.5 72.1

RELATIVE HUMIDITY: 85.0 77.0 72.0 65.0 59.0 52.0 87.0 91.0 91.0 82.0 77.0 79.0 90.0 96.0
90.0 96.0 100.0 100.0 77.0 79.0 84.0 87.0 90.0 90.0

BAROMETRIC PRES: 29.74

WALL

* Waller, Tuesday, August 22

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.4 78.3 80.9 85.5 87.7 90.0 92.4 87.7 89.0 89.2 89.8 90.4 91.8
89.6 86.9 84.5 83.9 82.5 81.6 79.8 78.8 77.9 77.4 77.5

RELATIVE HUMIDITY: 85.0 77.0 72.0 63.0 54.0 57.0 65.0 65.0 68.0 65.0 53.0 55.0 57.0 67.0
74.0 76.0 79.0 94.0 84.0 88.0 90.0 94.0 94.0 94.0

BAROMETRIC PRES: 29.84

Wednesday, August 23
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Wednesday, August 23

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.1 79.2 83.3 84.4 81.9 80.5 83.0 83.9 86.8 88.2 88.0 86.1 84.3
82.1 80.4 78.9 78.2 77.8 79.1 79.9 79.3 78.8 76.8 76.7

RELATIVE HUMIDITY: 94.5 90.5 73.5 67.0 74.5 88.0 74.5 66.5 61.5 56.5 59.0 66.5 73.5 79.5
87.5 92.5 95.0 95.0 92.0 94.0 94.0 96.0 98.0 97.0

BAROMETRIC PRES: 30.00

CHAM

* Chambers, Wednesday, August 23

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 74.2 75.2 78.1 81.8 78.6 76.0 77.1 78.9 80.7 83.1 85.7 85.6 85.3
83.9 82.6 82.1 81.3 79.5 78.5 77.2 76.1 75.3 74.5 74.0

RELATIVE HUMIDITY: 99.5 98.6 94.7 93.9 95.1 84.2 80.6 92.2 90.4 89.5 86.6 85.8 81.5 87.5
94.8 99.4 100.0 100.0 90.2 91.2 92.9 96.7 98.7 98.8

BAROMETRIC PRES: 30.00

FORT

* Fort Bend, Wednesday, August 23

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.9 77.4 80.5 81.6 82.3 85.8 85.7 84.1 85.5 87.5 89.5 89.9 88.5
87.2 85.3 83.6 82.1 80.6 80.0 79.0 78.3 77.7 77.0 76.6

RELATIVE HUMIDITY: 91.4 91.1 85.1 85.2 81.2 66.5 68.2 77.2 70.1 60.0 55.0 54.7 56.1 61.2
67.6 72.0 77.1 82.7 83.9 85.9 87.6 89.5 92.1 92.9

BAROMETRIC PRES: 29.99

GALV

* Galveston, Wednesday, August 23

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 81.7 80.2 80.3 82.0 83.8 82.3 80.4 80.5 81.9 83.2 84.0 85.0 85.0
84.3 83.7 83.8 84.0 83.9 84.7 84.5 84.5 84.2 84.0 83.7

RELATIVE HUMIDITY: 84.4 93.1 82.8 74.5 79.1 81.5 89.3 85.2 81.3 79.5 76.0 78.0 82.3 86.1
85.5 84.5 81.3 80.8 83.2 77.9 79.7 80.6 80.2 82.3

BAROMETRIC PRES: 29.99

HARR

* Harris, Wednesday, August 23

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.2 77.3 79.4 81.6 80.8 81.6 82.3 83.1 84.1 85.2 86.3 86.6 86.0
84.9 83.4 82.7 81.8 81.0 81.2 80.6 79.7 79.2 78.4 77.5

RELATIVE HUMIDITY: 93.7 90.8 84.0 79.3 78.0 73.9 74.0 71.1 67.6 65.2 64.8 67.3 70.3 75.9
81.4 84.7 88.3 90.7 89.0 89.9 91.8 92.7 93.1 93.6

BAROMETRIC PRES: 29.97

LIBE

* Liberty, Wednesday, August 23

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 74.1 74.2 75.9 79.0 80.8 81.4 82.6 79.2 79.1 83.0 84.9 84.9 83.6
82.6 81.4 80.1 78.4 77.0 76.3 75.7 74.8 74.6 74.1 73.8

RELATIVE HUMIDITY: 100.0 100.0 88.0 79.0 61.0 61.0 85.0 79.0 69.0 74.0 79.0 77.0 88.0
97.0 100.0 79.4 84.9 88.3 100.0 89.5 94.2 91.4 100.0 100.0

BAROMETRIC PRES: 29.77

MONT

* Montgomery, Wednesday, August 23

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 72.3 73.0 76.8 79.8 83.8 86.0 82.0 80.2 80.3 82.6 82.7 82.2 80.5
79.1 76.8 74.5 72.8 71.1 74.3 76.6 75.1 74.7 72.4 71.8

RELATIVE HUMIDITY: 100.0 100.0 88.0 79.0 61.0 61.0 85.0 79.0 69.0 74.0 79.0 77.0 88.0
97.0 100.0 79.4 84.9 88.3 100.0 89.5 94.2 91.4 100.0 100.0

BAROMETRIC PRES: 29.77

WALL

* Waller, Wednesday, August 23

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.7 77.9 79.8 84.4 85.5 87.0 89.9 90.8 89.7 88.9 89.8 90.3 89.0
86.7 84.2 82.9 81.0 80.1 80.6 79.1 77.8 77.5 77.4 78.1

RELATIVE HUMIDITY: 90.0 82.0 72.0 63.0 61.0 63.0 65.0 61.0 53.0 51.0 57.0 61.0 70.0 77.0
88.0 94.0 94.0 96.0 94.0 94.0 97.0 94.0 91.0 94.0

BAROMETRIC PRES: 29.87

Thursday August 24
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Thursday August 24

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.7 79.8 83.4 86.1 86.9 87.5 85.0 81.7 79.5 79.0 79.6 80.2 80.3
79.2 78.7 77.4 76.8 76.4 77.7 77.4 76.7 77.2 76.8 75.2

RELATIVE HUMIDITY: 97.0 83.0 72.0 64.0 60.0 55.5 69.5 86.0 84.5 88.5 92.0 89.5 91.0 92.0
93.5 98.0 97.0 98.0 98.5 98.5 98.0 97.0 98.0 97.0

BAROMETRIC PRES: 29.97

CHAM

* Chambers, Thursday August 24

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.2 75.8 78.7 83.7 86.2 87.2 88.0 84.2 77.9 74.3 76.2 77.9 78.5
78.5 77.3 76.6 75.7 75.6 77.8 76.8 76.2 75.8 75.6 75.2

RELATIVE HUMIDITY: 100.0 100.0 100.0 100.0 96.4 89.3 70.4 78.2 94.5 92.8 94.2 94.2 92.3
92.9 94.8 96.3 96.7 97.0 100.0 100.0 100.0 100.0 100.0 100.0

BAROMETRIC PRES: 29.98

FORT

* Fort Bend, Thursday August 24

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.3 77.4 81.5 85.2 87.2 88.6 90.9 93.3 91.6 85.8 85.2 83.3 82.3
81.6 80.4 79.9 78.9 78.0 79.7 79.0 78.1 77.6 77.0 76.6

RELATIVE HUMIDITY: 95.1 91.2 81.5 76.0 66.5 60.8 54.5 49.6 63.3 73.2 76.6 82.0 82.9 84.4
84.9 84.2 85.7 88.3 86.0 88.6 91.0 93.8 94.8 95.4

BAROMETRIC PRES: 29.96

GALV

* Galveston, Thursday August 24

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.5 80.2 81.5 82.8 83.7 81.6 83.7 85.0 84.2 82.7 81.2 80.6 80.5
81.3 81.4 81.4 81.5 81.7 83.9 84.0 84.0 83.8 83.3 82.1

RELATIVE HUMIDITY: 89.1 88.1 87.6 82.2 77.5 85.8 87.0 75.6 80.1 87.6 84.5 86.6 84.5 86.9
86.7 84.2 82.5 83.1 83.0 82.0 83.4 82.8 84.8 85.9

BAROMETRIC PRES: 29.96

HARR

* Harris, Thursday August 24

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.1 78.6 81.0 83.9 85.9 88.0 89.3 89.0 84.4 81.6 80.2 80.0 80.0 79.7 79.0 78.5 78.0 77.7 80.4 79.9 79.2 78.6 77.9 77.8

RELATIVE HUMIDITY: 95.9 89.3 82.3 73.0 66.7 60.1 59.5 60.2 77.5 86.6 88.2 87.6 89.2 91.6 93.7 94.3 95.0 96.2 93.5 93.4 94.6 96.3 96.7 96.5

BAROMETRIC PRES: 29.95

LIBE

* Liberty, Thursday August 24

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 73.9 74.4 77.3 81.5 84.6 86.0 86.4 86.5 83.1 82.3 79.5 79.9 79.6 78.9 77.5 76.8 76.1 75.4 76.1 75.5 75.4 74.9 74.6 74.3

RELATIVE HUMIDITY: 96.6 89.3 79.7 90.0 85.0 53.0 47.0 41.0 52.0 61.0 61.0 65.0 74.0 85.0 88.0 88.0 94.0 94.0 92.4 94.0 95.7 96.3 97.1 96.2

BAROMETRIC PRES: 29.74

MONT

* Montgomery, Thursday August 24

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 68.0 70.9 73.7 78.8 81.2 88.0 90.1 92.5 91.2 89.6 84.8 84.0 81.5 79.1 77.4 76.3 74.7 73.3 69.9 70.2 69.0 68.7 68.5 67.3

RELATIVE HUMIDITY: 96.6 89.3 79.7 90.0 85.0 53.0 47.0 41.0 52.0 61.0 61.0 65.0 74.0 85.0 88.0 88.0 94.0 94.0 92.4 94.0 95.7 96.3 97.1 96.2

BAROMETRIC PRES: 29.74

WALL

* Waller, Thursday August 24

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.6 77.7 79.2 84.5 87.5 91.3 93.0 95.3 96.3 97.3 83.1 83.9 82.8 82.0 81.7 81.8 82.6 82.8 79.6 78.1 78.2 78.1 77.5 77.5

RELATIVE HUMIDITY: 97.0 85.0 77.0 61.0 52.0 46.0 41.0 37.0 67.0 90.0 90.0 85.0 87.0 94.0 100.0 100.0 97.0 100.0 97.0 94.0 97.0 100.0 100.0 100.0

BAROMETRIC PRES: 29.84

Friday, August 25
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Friday, August 25

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.6 79.8 82.9 84.9 87.1 84.6 87.2 88.5 89.8 89.4 88.7 86.3 84.3
81.8 79.8 78.3 77.5 76.4 75.7 75.5 75.8 75.1 74.1 73.5

RELATIVE HUMIDITY: 97.0 85.0 74.0 66.5 61.0 75.5 61.0 58.5 56.5 57.5 61.0 67.0 71.0 79.5
86.5 92.0 95.5 97.0 98.0 98.0 97.0 98.5 98.5 98.5

BAROMETRIC PRES: 29.91

CHAM

* Chambers, Friday, August 25

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 73.1 73.4 76.3 79.8 83.4 85.8 87.8 89.7 91.1 91.3 90.7 89.1 87.4
85.1 83.1 82.0 80.2 79.2 75.3 74.6 74.1 73.5 73.3 73.3

RELATIVE HUMIDITY: 99.8 98.0 91.9 88.2 79.0 73.6 71.7 69.7 65.6 58.3 58.6 63.7 70.7 74.6
82.2 84.6 89.2 91.6 97.7 98.5 99.0 99.7 99.9 100.0

BAROMETRIC PRES: 29.91

FORT

* Fort Bend, Friday, August 25

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 74.9 76.4 80.6 84.8 86.5 88.4 90.5 93.0 94.6 94.5 93.0 93.1 92.2
89.2 86.3 84.1 82.2 80.6 77.3 76.6 75.9 75.3 75.2 74.9

RELATIVE HUMIDITY: 98.2 93.9 85.4 75.5 65.9 56.8 51.8 46.4 44.1 47.0 47.3 49.4 50.9 60.8
62.5 68.7 76.5 80.3 91.1 94.2 96.5 98.2 98.5 98.9

BAROMETRIC PRES: 29.90

GALV

* Galveston, Friday, August 25

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.5 79.3 80.8 81.6 82.8 84.2 85.1 85.8 86.6 87.0 87.0 86.8 86.4
85.3 84.5 84.1 83.7 83.5 81.8 81.7 81.1 80.1 79.9 79.7

RELATIVE HUMIDITY: 90.7 94.3 86.5 85.5 84.6 75.2 76.3 76.6 76.8 75.9 76.0 75.2 76.8 79.0
81.6 83.3 84.5 82.8 83.1 85.0 83.0 83.0 86.5 89.7

BAROMETRIC PRES: 29.90

HARR

* Harris, Friday, August 25

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.4 77.5 79.6 82.6 84.6 86.8 88.4 89.9 91.2 92.3 92.0 91.0 89.3
87.1 85.1 83.4 81.9 80.9 77.6 77.5 76.8 76.4 76.0 76.1

RELATIVE HUMIDITY: 97.3 93.3 84.1 75.5 67.5 60.0 57.5 53.5 50.9 49.2 50.1 53.6 60.3 66.7
72.5 77.0 82.6 85.9 97.2 97.5 97.5 97.9 97.9 98.6

BAROMETRIC PRES: 29.88

LIBE

* Liberty, Friday, August 25

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 72.3 72.8 75.2 79.1 82.4 84.9 86.8 89.0 90.8 91.6 91.4 90.6 89.0
86.4 83.6 81.5 79.9 78.7 74.7 73.9 73.3 72.7 72.6 72.3

RELATIVE HUMIDITY: 100.0 94.0 79.0 65.0 57.0 50.0 46.0 40.0 39.0 37.0 39.0 41.0 47.0 59.0
67.0 74.0 82.0 85.0 94.0 94.0 94.0 100.0 100.0 100.0

BAROMETRIC PRES: 29.67

MONT

* Montgomery, Friday, August 25

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 70.7 72.9 78.0 82.7 85.6 88.0 90.7 92.8 94.5 95.3 94.8 93.9 91.4
88.1 84.9 82.9 80.9 79.0 72.9 72.0 71.9 70.8 70.6 70.3

RELATIVE HUMIDITY: 100.0 94.0 79.0 65.0 57.0 50.0 46.0 40.0 39.0 37.0 39.0 41.0 47.0 59.0
67.0 74.0 82.0 85.0 94.0 94.0 94.0 100.0 100.0 100.0

BAROMETRIC PRES: 29.67

WALL

* Waller, Friday, August 25

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 82.3 82.3 79.7 83.8 87.1 87.8 92.5 94.8 95.3 97.6 97.5 97.0 95.0
92.0 89.0 86.7 84.5 82.1 82.7 83.1 82.1 82.2 82.4 82.1

RELATIVE HUMIDITY: 96.0 90.0 85.0 70.0 61.0 55.0 52.0 46.0 44.0 44.0 46.0 47.0 57.0 65.0
72.0 72.0 85.0 88.0 100.0 100.0 97.0 97.0 97.0 97.0

BAROMETRIC PRES: 29.78

Saturday, August 26
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Saturday, August 26

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.4 79.4 83.3 85.4 86.9 89.8 90.9 91.0 91.2 90.4 89.7 88.2 85.6
83.4 82.0 81.3 79.2 78.6 75.7 75.9 75.8 75.2 74.8 73.9

RELATIVE HUMIDITY: 97.0 85.0 72.5 63.0 57.5 54.0 54.5 55.5 55.0 55.5 50.0 55.0 65.0 74.0
79.0 82.0 90.0 94.0 98.0 97.0 98.0 98.0 98.0 98.5

BAROMETRIC PRES: 29.84

CHAM

* Chambers, Saturday, August 26

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 74.4 74.6 77.9 82.1 84.9 87.0 88.0 90.4 92.1 92.6 92.1 90.4 88.1
85.7 84.1 82.7 81.7 79.9 78.6 78.4 78.0 77.5 76.3 75.1

RELATIVE HUMIDITY: 98.2 97.1 91.7 86.5 76.3 67.7 64.4 63.5 59.9 61.3 64.2 61.9 62.3 68.2
78.4 86.0 90.3 91.4 92.9 94.7 96.2 96.7 97.4 98.0

BAROMETRIC PRES: 29.83

FORT

* Fort Bend, Saturday, August 26

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 74.4 75.4 81.0 85.0 87.5 89.7 92.0 93.3 93.7 96.4 96.8 94.9 93.0
89.9 86.5 83.9 81.9 80.3 79.2 78.2 77.5 76.8 75.5 74.9

RELATIVE HUMIDITY: 95.6 92.1 82.1 75.1 63.1 54.6 50.6 45.4 42.7 39.0 41.4 47.5 49.7 53.1
62.8 71.9 76.9 81.1 84.0 86.5 86.9 88.9 93.1 94.6

BAROMETRIC PRES: 29.82

GALV

* Galveston, Saturday, August 26

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 80.1 80.1 80.1 82.6 84.4 85.0 85.6 86.2 87.0 87.9 87.9 87.6 86.8
85.7 84.9 84.5 84.2 84.0 83.4 83.1 82.4 81.0 80.5 79.8

RELATIVE HUMIDITY: 91.3 93.3 85.8 79.5 77.2 73.3 72.6 70.4 70.5 70.4 70.9 71.9 72.9 76.1
79.1 80.1 81.9 82.8 81.9 83.7 84.8 86.5 86.8 89.2

BAROMETRIC PRES: 29.82

HARR

* Harris, Saturday, August 26

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.5 77.4 80.3 83.7 86.4 88.4 90.1 91.6 92.8 93.4 93.1 92.1 90.4 87.9 85.3 83.3 82.0 80.8 79.8 78.9 78.1 77.5 76.8 76.3

RELATIVE HUMIDITY: 95.3 89.6 81.4 72.2 63.1 56.1 51.9 49.5 46.6 46.4 49.8 54.4 56.8 61.8 69.9 77.7 82.4 86.7 90.0 92.3 93.7 94.1 95.8 97.0

BAROMETRIC PRES: 29.80

LIBE

* Liberty, Saturday, August 26

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 72.5 72.9 76.6 80.7 83.7 86.3 88.4 90.2 92.0 92.7 92.8 92.0 90.0 86.8 84.0 82.0 80.3 78.4 77.7 76.7 75.7 74.8 73.7 72.9

RELATIVE HUMIDITY: 94.0 82.0 74.0 61.0 52.0 44.0 42.0 36.0 34.0 35.0 36.0 41.0 50.0 59.0 61.0 69.0 74.0 82.0 88.0 94.0 94.0 94.0 97.0 93.0

BAROMETRIC PRES: 29.59

MONT

* Montgomery, Saturday, August 26

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 70.9 75.1 79.1 83.9 86.9 90.2 91.6 94.6 96.3 96.2 96.7 95.2 92.1 89.0 86.2 83.3 81.1 78.5 77.3 75.3 74.1 73.1 71.5 70.7

RELATIVE HUMIDITY: 94.0 82.0 74.0 61.0 52.0 44.0 42.0 36.0 34.0 35.0 36.0 41.0 50.0 59.0 61.0 69.0 74.0 82.0 88.0 94.0 94.0 94.0 97.0 93.0

BAROMETRIC PRES: 29.59

WALL

* Waller, Saturday, August 26

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.9 77.9 79.3 84.4 88.8 91.2 93.3 95.2 97.7 98.7 99.4 99.6 98.1 93.3 89.6 87.4 84.8 82.7 80.8 79.9 79.0 78.3 79.0 79.7

RELATIVE HUMIDITY: 96.0 85.0 77.0 65.0 57.0 49.0 47.0 43.0 39.0 39.0 39.0 54.0 55.0 59.0 65.0 74.0 82.0 90.0 96.0 97.0 97.0 96.0 97.0 100.0

BAROMETRIC PRES: 29.70

Sunday, August 27
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Sunday, August 27

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.6 82.3 85.1 87.0 88.2 90.9 91.0 92.1 91.0 89.9 89.0 87.2 84.8
82.7 81.5 80.0 79.3 77.9 78.4 77.7 77.9 77.6 78.1 77.5

RELATIVE HUMIDITY: 94.0 82.0 70.0 61.0 59.0 57.0 56.5 52.5 53.0 59.5 60.5 64.5 75.0 81.0
83.5 89.0 93.5 95.0 94.0 96.0 96.0 97.0 94.0 97.0

BAROMETRIC PRES: 29.81

CHAM

* Chambers, Sunday, August 27

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.7 76.2 78.8 82.6 85.8 87.8 90.7 91.8 91.6 91.4 90.6 89.5 87.7
85.5 84.1 83.5 82.7 82.6 78.5 77.5 77.4 77.2 76.8 76.3

RELATIVE HUMIDITY: 97.8 97.0 92.7 86.6 81.6 70.3 63.0 64.9 67.5 66.6 64.0 63.0 65.5 71.2
81.6 88.7 90.5 92.1 93.6 94.0 95.0 96.5 97.4 97.5

BAROMETRIC PRES: 29.81

FORT

* Fort Bend, Sunday, August 27

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.1 76.1 81.6 85.7 88.0 90.7 92.9 94.9 96.1 95.4 95.8 93.8 91.7
89.2 86.4 84.1 82.4 81.1 78.9 78.1 77.2 76.4 76.0 75.3

RELATIVE HUMIDITY: 96.2 93.4 82.5 75.1 71.1 61.3 51.9 42.1 45.1 44.8 44.6 52.3 54.5 59.3
66.0 75.2 80.8 83.4 84.4 86.6 89.3 91.9 94.0 95.8

BAROMETRIC PRES: 29.80

GALV

* Galveston, Sunday, August 27

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 82.9 81.8 82.4 84.4 85.8 86.9 87.8 88.0 88.4 88.3 88.1 87.6 86.8
85.8 85.1 84.7 84.5 84.4 83.9 83.6 83.6 83.5 83.5 83.3

RELATIVE HUMIDITY: 84.3 83.5 78.0 74.4 74.4 75.7 73.8 70.1 73.6 73.4 75.6 76.0 74.4 77.1
81.4 83.1 84.0 83.4 83.6 83.3 84.2 83.6 83.5 84.4

BAROMETRIC PRES: 29.80

HARR

* Harris, Sunday, August 27

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.3 78.4 81.3 84.2 87.0 89.5 91.3 92.6 92.9 93.0 92.6 91.4 89.7
87.3 85.1 83.5 82.4 81.6 79.8 79.3 78.8 78.4 78.1 77.5

RELATIVE HUMIDITY: 95.5 90.1 81.3 72.7 66.1 57.3 52.1 49.1 51.2 52.9 53.9 55.2 59.4 65.2
73.2 80.1 83.9 86.4 90.1 91.7 93.9 94.9 95.2 95.8

BAROMETRIC PRES: 29.77

LIBE

* Liberty, Sunday, August 27

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 71.9 72.7 77.0 81.9 84.9 87.7 90.4 92.0 92.4 92.9 92.5 91.3 88.9
86.1 83.7 82.2 80.7 79.7 77.3 76.3 75.1 74.1 73.4 72.4

RELATIVE HUMIDITY: 90.0 79.0 70.0 57.0 45.0 43.0 37.0 36.0 36.0 34.0 42.0 51.0 57.0 65.0
70.0 72.0 82.0 85.0 88.0 91.0 93.0 96.0 93.0 96.0

BAROMETRIC PRES: 29.56

MONT

* Montgomery, Sunday, August 27

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 70.3 75.3 80.7 85.7 88.2 91.3 93.6 95.9 96.1 96.6 96.5 94.1 90.6
87.5 85.1 83.0 80.5 79.0 76.6 74.5 72.1 70.6 70.2 69.2

RELATIVE HUMIDITY: 90.0 79.0 70.0 57.0 45.0 43.0 37.0 36.0 36.0 34.0 42.0 51.0 57.0 65.0
70.0 72.0 82.0 85.0 88.0 91.0 93.0 96.0 93.0 96.0

BAROMETRIC PRES: 29.56

WALL

* Waller, Sunday, August 27

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.1 76.7 80.4 86.4 88.5 92.1 94.3 96.1 98.1 99.9 100.8 97.2
95.6 92.0 89.3 87.1 84.8 83.1 81.2 79.7 78.9 78.3 78.2 78.0

RELATIVE HUMIDITY: 96.0 85.0 72.0 59.0 54.0 49.0 44.0 40.0 37.0 40.0 49.0 51.0 57.0 61.0
70.0 77.0 82.0 87.0 94.0 97.0 100.0 100.0 96.0 96.0

BAROMETRIC PRES: 29.67

Monday, August 28
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Monday, August 28

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.0 82.1 85.2 87.7 90.0 91.0 91.8 92.2 92.4 91.5 89.7 88.1 85.2
82.7 81.1 80.0 79.0 78.3 77.9 76.9 76.5 76.5 76.2 75.6

RELATIVE HUMIDITY: 97.0 83.5 71.0 54.5 50.5 51.5 48.5 45.0 47.5 48.5 55.0 61.0 73.5 81.0
86.0 91.0 91.5 95.0 97.0 96.5 97.0 98.5 98.0 98.0

BAROMETRIC PRES: 29.85

CHAM

* Chambers, Monday, August 28

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.9 76.7 80.2 84.3 85.7 87.9 89.3 90.8 92.5 92.8 91.6 90.1 88.1
85.5 83.7 82.5 82.1 79.9 82.2 81.7 80.4 79.0 78.1 77.8

RELATIVE HUMIDITY: 97.5 96.2 89.8 84.1 78.0 68.7 61.9 57.3 58.4 56.0 56.3 56.1 59.6 70.3
83.3 90.1 92.2 93.1 93.1 93.9 94.4 95.2 96.0 96.7

BAROMETRIC PRES: 29.84

FORT

* Fort Bend, Monday, August 28

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.7 76.8 81.7 86.0 88.8 91.1 93.0 94.9 96.2 97.9 98.2 96.6 93.8
90.6 87.1 84.6 82.7 81.2 79.8 78.8 78.1 77.2 76.8 76.2

RELATIVE HUMIDITY: 96.2 91.8 81.5 70.2 57.2 53.2 46.4 37.9 34.5 34.2 34.9 38.5 45.0 52.9
66.6 76.3 81.2 84.4 87.1 89.8 90.8 92.4 94.2 95.5

BAROMETRIC PRES: 29.83

GALV

* Galveston, Monday, August 28

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 82.7 82.1 82.5 83.4 85.2 86.6 87.8 88.8 89.2 89.1 88.7 87.8 87.1
86.0 85.1 84.7 84.5 84.4 84.4 84.3 84.2 84.0 83.9 83.6

RELATIVE HUMIDITY: 85.7 84.5 77.4 78.9 71.8 70.6 70.7 68.7 67.7 68.7 70.5 73.2 76.0 79.1
80.5 81.6 82.6 81.6 83.8 83.0 83.1 82.8 81.5 83.7

BAROMETRIC PRES: 29.83

HARR

* Harris, Monday, August 28

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.8 79.0 82.1 85.3 87.6 89.8 91.8 93.4 94.2 94.5 94.2 93.0 91.0
88.2 85.5 83.6 82.5 81.5 80.7 80.1 79.6 79.1 78.5 78.0

RELATIVE HUMIDITY: 95.5 88.0 79.5 69.3 58.8 53.8 49.1 43.3 41.7 43.2 44.6 48.0 54.0 61.4
72.9 81.1 85.2 87.6 90.6 92.0 93.9 93.5 95.2 95.7

BAROMETRIC PRES: 29.81

LIBE

* Liberty, Monday, August 28

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 72.9 73.5 77.7 82.6 85.6 88.0 89.6 91.2 92.7 93.5 93.3 91.9 89.9
86.6 83.8 81.7 80.3 78.5 78.9 78.2 76.7 75.1 74.2 73.5

RELATIVE HUMIDITY: 91.0 79.0 68.0 61.0 49.0 46.0 40.0 33.0 36.0 34.0 37.0 44.0 49.0 55.0
63.0 69.0 79.0 85.0 88.0 94.0 90.0 94.0 94.0 93.0

BAROMETRIC PRES: 29.60

MONT

* Montgomery, Monday, August 28

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 71.5 76.1 81.1 85.1 88.6 90.6 92.7 96.3 95.5 96.9 96.6 95.4 92.7
89.0 85.6 83.9 81.2 79.7 77.2 75.6 74.7 72.5 72.1 70.4

RELATIVE HUMIDITY: 91.0 79.0 68.0 61.0 49.0 46.0 40.0 33.0 36.0 34.0 37.0 44.0 49.0 55.0
63.0 69.0 79.0 85.0 88.0 94.0 90.0 94.0 94.0 93.0

BAROMETRIC PRES: 29.60

WALL

* Waller, Monday, August 28

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 81.6 80.9 81.1 87.1 89.9 92.8 95.2 96.4 99.0 99.0 99.1 100.6
98.8 93.9 90.0 87.6 85.3 83.6 82.2 81.2 80.6 80.2 80.4 80.8

RELATIVE HUMIDITY: 97.0 82.0 70.0 59.0 50.0 46.0 41.0 36.0 36.0 33.0 34.0 44.0 50.0 53.0
65.0 74.0 79.0 87.0 94.0 96.0 96.0 97.0 100.0 96.0

BAROMETRIC PRES: 29.71

Tuesday, August 29
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Tuesday, August 29

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.8 82.6 85.4 87.3 89.6 91.7 92.7 94.4 93.5 92.3 91.0 88.6 85.8
82.9 82.0 80.1 77.8 78.0 77.2 76.6 76.6 76.1 75.7 75.7

RELATIVE HUMIDITY: 97.0 85.0 73.5 62.0 56.5 48.0 44.5 44.0 47.5 56.0 57.5 62.0 72.0 78.5
81.0 87.5 97.0 94.0 97.0 96.0 96.0 97.0 98.5 97.0

BAROMETRIC PRES: 29.86

CHAM

* Chambers, Tuesday, August 29

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.3 74.8 78.4 82.6 86.3 89.0 91.3 93.4 94.5 95.1 94.6 93.1 90.6
87.1 84.5 82.3 80.6 79.8 78.8 78.6 78.4 77.5 76.3 75.3

RELATIVE HUMIDITY: 97.7 96.5 92.1 86.2 77.9 67.7 60.9 55.5 50.0 48.4 52.7 63.3 68.6 74.8
81.1 84.8 87.7 91.1 93.8 94.7 95.7 96.3 97.2 97.5

BAROMETRIC PRES: 29.85

FORT

* Fort Bend, Tuesday, August 29

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.3 76.1 81.3 85.9 88.3 90.7 93.4 95.8 97.7 99.2 99.5 98.4 94.6
91.0 87.8 85.7 83.8 82.3 80.1 79.0 78.3 77.7 76.5 75.7

RELATIVE HUMIDITY: 95.9 92.4 82.0 74.0 65.4 54.9 48.6 39.3 36.4 33.5 31.8 40.6 55.4 61.5
63.7 67.8 74.3 80.8 85.9 87.6 86.9 89.0 92.3 95.1

BAROMETRIC PRES: 29.85

GALV

* Galveston, Tuesday, August 29

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 81.2 80.1 81.9 83.9 85.5 87.1 87.5 87.9 88.7 88.8 88.8 88.7 88.1
86.8 86.1 85.3 85.1 84.5 84.3 84.1 84.0 84.0 83.2 82.1

RELATIVE HUMIDITY: 85.7 86.6 80.5 77.9 77.9 73.1 73.2 73.5 73.0 72.0 71.9 71.8 74.7 78.2
79.7 82.6 85.6 84.3 87.6 83.7 84.1 84.5 84.1 83.8

BAROMETRIC PRES: 29.85

HARR

* Harris, Tuesday, August 29

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.1 78.1 81.3 84.9 87.8 90.3 92.2 94.1 95.6 96.8 96.5 94.8 92.4 89.4 86.5 84.6 83.2 81.9 80.5 79.6 78.9 78.2 77.7 77.2

RELATIVE HUMIDITY: 94.9 89.1 80.5 72.1 62.4 54.1 47.4 41.8 37.9 39.1 40.9 49.4 60.3 67.2 72.6 76.2 79.4 84.9 89.8 92.4 93.9 94.8 95.8 96.0

BAROMETRIC PRES: 29.83

LIBE

* Liberty, Tuesday, August 29

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 72.7 72.8 77.2 81.7 85.1 87.9 90.4 92.7 94.4 95.8 96.4 95.3 93.1 89.2 85.8 83.2 81.1 79.8 77.6 76.8 76.2 75.2 73.6 73.0

RELATIVE HUMIDITY: 94.0 79.0 72.0 57.0 49.0 40.0 33.0 32.0 28.0 26.0 28.0 29.0 42.0 54.0 63.0 72.0 74.0 77.0 88.0 94.0 94.0 96.0 93.0 96.0

BAROMETRIC PRES: 29.61

MONT

* Montgomery, Tuesday, August 29

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 71.0 76.1 80.9 85.2 88.2 91.9 94.9 96.2 98.3 99.6 100.0 99.1 96.1 92.9 88.8 86.4 84.1 82.6 77.9 76.4 75.3 73.5 71.2 70.4

RELATIVE HUMIDITY: 94.0 79.0 72.0 57.0 49.0 40.0 33.0 32.0 28.0 26.0 28.0 29.0 42.0 54.0 63.0 72.0 74.0 77.0 88.0 94.0 94.0 96.0 93.0 96.0

BAROMETRIC PRES: 29.61

WALL

* Waller, Tuesday, August 29

SUNRISE/SUNSET : 7 8

HOURLY TEMPERATURES: 79.7 79.8 79.0 85.9 89.7 93.6 95.8 97.2 99.2 101.9 102.5 102.1 100.9 96.4 91.7 89.0 86.8 84.9 82.5 81.4 80.8 80.6 80.8 80.3

RELATIVE HUMIDITY: 96.0 85.0 72.0 59.0 49.0 46.0 40.0 34.0 30.0 32.0 32.0 35.0 57.0 65.0 68.0 77.0 77.0 85.0 96.0 96.0 100.0 100.0 100.0 100.0

BAROMETRIC PRES: 29.72

Wednesday, August 30
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Wednesday, August 30

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.5 79.7 83.4 86.5 89.7 92.8 95.7 97.9 99.4 98.2 95.2 91.9 88.7
85.9 84.4 82.7 80.9 79.1 76.9 76.3 75.3 74.2 75.4 75.2

RELATIVE HUMIDITY: 97.0 87.5 75.0 63.5 51.5 40.0 37.0 33.5 30.0 38.0 52.0 59.5 68.5 76.0
79.5 85.0 87.5 92.0 97.0 95.5 98.5 98.0 98.5 98.5

BAROMETRIC PRES: 29.81

CHAM

* Chambers, Wednesday, August 30

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.5 75.8 78.9 83.1 86.7 90.2 93.3 96.2 98.6 100.2 100.3 99.5
97.1 91.7 87.9 84.9 83.5 83.2 79.2 78.8 78.2 78.1 77.8 76.8

RELATIVE HUMIDITY: 97.8 97.1 92.3 85.8 74.1 63.1 52.6 45.9 40.4 36.7 35.1 35.1 43.0 64.4
78.3 85.0 87.6 85.1 92.9 94.0 95.7 96.5 96.6 97.0

BAROMETRIC PRES: 29.79

FORT

* Fort Bend, Wednesday, August 30

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.7 77.2 80.0 83.1 86.9 90.1 93.9 97.7 100.3 101.8 102.5 103.3
101.8 98.3 93.2 90.1 87.9 86.1 81.0 80.2 79.3 78.2 77.8 77.3

RELATIVE HUMIDITY: 93.9 92.7 85.3 78.4 63.8 54.1 40.1 33.1 26.3 22.5 21.2 21.1 22.0 39.6
60.2 64.6 67.0 62.9 84.9 87.1 86.9 88.3 89.5 91.9

BAROMETRIC PRES: 29.79

GALV

* Galveston, Wednesday, August 30

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.7 78.2 78.9 81.1 84.4 87.7 90.5 92.2 92.4 92.9 92.7 92.1 90.5
88.1 86.4 85.7 84.9 84.3 83.9 82.7 82.1 81.1 80.0 79.6

RELATIVE HUMIDITY: 97.3 97.8 94.3 90.0 81.0 67.7 59.3 57.5 67.3 71.7 73.5 74.4 80.5 85.6
88.7 90.5 91.8 92.5 86.8 86.2 89.0 92.5 96.4 96.2

BAROMETRIC PRES: 29.79

HARR

* Harris, Wednesday, August 30

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.2 78.8 80.8 83.9 87.4 90.6 93.8 96.6 98.6 100.3 101.0 100.5

98.5 94.5 90.4 88.0 86.4 85.2 80.7 80.0 79.2 78.5 78.1 78.0

RELATIVE HUMIDITY: 93.7 90.4 82.0 71.2 59.5 50.1 40.0 34.3 30.1 27.3 26.9 30.4 36.5 51.6
66.9 72.1 73.6 71.6 88.7 90.8 92.6 94.8 94.2 95.2

BAROMETRIC PRES: 29.77

LIBE

* Liberty, Wednesday, August 30

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 74.8 75.0 77.8 81.5 85.4 89.0 92.5 95.7 98.1 100.0 100.8 100.5

98.8 93.8 88.9 86.6 84.9 83.7 79.3 78.7 77.8 76.5 75.8 75.4

RELATIVE HUMIDITY: 87.0 82.0 61.0 53.0 43.0 32.0 27.0 23.0 23.0 22.0 21.0 22.0 36.0 45.0
42.0 57.0 61.0 61.0 77.0 82.0 87.0 88.0 91.0 88.0

BAROMETRIC PRES: 29.56

MONT

* Montgomery, Wednesday, August 30

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.8 78.2 82.0 85.6 88.7 92.7 96.2 99.5 100.7 102.2 102.8 102.5

97.2 92.9 91.5 87.4 87.1 86.3 82.0 80.2 78.8 77.7 76.6 76.5

RELATIVE HUMIDITY: 87.0 82.0 61.0 53.0 43.0 32.0 27.0 23.0 23.0 22.0 21.0 22.0 36.0 45.0
42.0 57.0 61.0 61.0 77.0 82.0 87.0 88.0 91.0 88.0

BAROMETRIC PRES: 29.56

WALL

* Waller, Wednesday, August 30

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 81.8 81.6 80.3 83.5 89.1 93.7 97.6 100.8 103.5 105.5 105.6

105.7 104.8 100.7 95.8 93.1 91.2 88.6 82.9 81.3 80.5 80.3 79.9 80.2

RELATIVE HUMIDITY: 94.0 88.0 74.0 57.0 46.0 37.0 27.0 26.0 23.0 22.0 23.0 26.0 30.0 41.0
63.0 65.0 63.0 60.0 88.0 94.0 97.0 100.0 97.0 100.0

BAROMETRIC PRES: 29.67

Thursday August 31
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Thursday August 31

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.4 80.2 84.4 89.2 92.5 96.3 99.3 100.9 102.0 102.4 100.9 97.6
92.9 89.2 86.5 84.0 82.6 80.9 78.8 77.8 77.4 76.8 76.3 76.0

RELATIVE HUMIDITY: 93.0 82.0 58.5 46.5 39.5 30.5 27.0 26.5 26.0 27.0 33.5 40.5 46.5 59.0
64.0 66.0 69.5 73.5 90.0 93.0 95.0 97.0 97.0 98.5

BAROMETRIC PRES: 29.74

CHAM

* Chambers, Thursday August 31

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.3 78.5 81.9 86.2 90.9 95.4 98.9 101.2 103.3 104.1 104.0
103.1 100.4 95.1 92.0 90.0 88.6 87.1 82.2 79.9 79.5 79.9 79.5 78.3

RELATIVE HUMIDITY: 87.5 86.2 72.0 59.7 52.4 42.8 37.6 44.9 43.2 32.4 32.0 32.0 32.5 35.0
45.8 59.6 61.9 63.4 85.1 82.6 82.2 81.6 83.3 84.8

BAROMETRIC PRES: 29.73

FORT

* Fort Bend, Thursday August 31

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.0 78.0 80.9 85.4 90.2 95.2 99.7 102.5 103.7 104.9 105.7
105.8 104.1 101.2 97.9 94.7 91.4 88.7 84.3 82.7 81.5 80.3 79.6 78.9

RELATIVE HUMIDITY: 84.2 83.1 67.3 54.4 41.7 31.7 26.1 23.6 22.6 21.9 21.2 21.1 22.0 24.2
29.1 42.7 45.3 48.1 66.2 73.0 73.7 79.0 80.1 80.9

BAROMETRIC PRES: 29.73

GALV

* Galveston, Thursday August 31

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.1 78.6 79.1 82.3 86.2 90.8 94.7 97.2 97.2 96.7 96.0 95.0 93.5
91.2 89.4 88.5 87.9 86.5 83.5 81.8 80.9 81.3 80.4 79.8

RELATIVE HUMIDITY: 99.3 98.6 92.3 81.3 67.6 53.7 42.1 40.7 60.9 67.4 66.7 71.3 78.5 82.4
82.6 71.2 72.1 76.1 88.5 90.7 93.4 95.5 97.7 98.3

BAROMETRIC PRES: 29.73

HARR

* Harris, Thursday August 31

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.9 79.8 83.0 87.0 91.7 95.9 99.3 101.6 103.1 104.0 104.2

103.8 101.8 98.5 95.3 92.8 90.7 88.5 83.8 82.8 81.8 80.9 80.4 79.7

RELATIVE HUMIDITY: 83.1 75.9 60.8 49.6 38.6 32.3 28.4 26.8 25.5 24.9 24.8 25.5 30.2 37.7

42.7 50.3 53.3 55.8 73.2 73.5 75.5 77.6 79.1 81.0

BAROMETRIC PRES: 29.71

LIBE

* Liberty, Thursday August 31

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.0 76.4 80.6 85.8 91.2 95.6 98.6 100.9 102.7 103.5 103.9

103.8 101.6 96.5 91.6 90.0 88.4 86.5 82.4 81.2 80.1 79.4 78.2 76.8

RELATIVE HUMIDITY: 79.0 46.0 39.0 31.0 29.0 24.0 22.0 24.0 21.0 22.0 20.0 22.0 36.0 46.0

41.0 46.0 56.0 46.0 59.0 57.0 65.0 74.0 76.0 79.0

BAROMETRIC PRES: 29.50

MONT

* Montgomery, Thursday August 31

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 74.7 81.3 86.6 92.0 96.6 100.3 102.7 102.7 104.7 104.4 104.5

103.8 98.6 93.8 91.4 89.8 86.8 88.8 84.6 83.5 80.5 78.0 76.1 74.4

RELATIVE HUMIDITY: 79.0 46.0 39.0 31.0 29.0 24.0 22.0 24.0 21.0 22.0 20.0 22.0 36.0 46.0

41.0 46.0 56.0 46.0 59.0 57.0 65.0 74.0 76.0 79.0

BAROMETRIC PRES: 29.50

WALL

* Waller, Thursday August 31

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.2 76.6 81.5 89.4 95.3 99.7 102.5 105.1 107.4 107.9 108.1

108.5 107.3 103.8 99.0 94.9 92.3 89.2 85.8 83.2 81.2 80.2 78.7 77.3

RELATIVE HUMIDITY: 77.1 69.5 53.9 40.7 27.0 24.0 23.0 23.0 21.0 21.0 21.0 23.0 36.0 50.0

43.0 48.0 55.0 59.0 67.0 72.0 77.0 79.0 72.0 75.2

BAROMETRIC PRES: 29.61

Friday, September 1
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Friday, September 1

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.0 80.3 84.4 88.4 91.4 94.7 96.9 98.4 98.0 97.7 96.1 93.3 89.5
86.7 86.3 83.7 83.2 82.1 79.9 79.2 78.4 77.8 77.4 76.8

RELATIVE HUMIDITY: 93.0 85.0 70.0 60.0 50.0 42.0 40.0 37.5 42.0 41.5 45.5 49.5 55.5 63.5
64.0 72.5 76.0 83.5 78.5 82.0 85.0 89.0 90.5 92.5

BAROMETRIC PRES: 29.78

CHAM

* Chambers, Friday, September 1

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.7 78.5 82.6 86.1 90.8 94.2 96.7 99.6 101.5 102.9 104.0 95.0
87.2 84.6 82.7 81.8 80.8 81.1 84.0 82.3 80.9 79.0 77.3 76.5

RELATIVE HUMIDITY: 80.9 85.0 80.0 70.5 62.5 58.7 51.2 45.0 41.4 37.7 36.7 38.0 50.3 61.3
64.8 63.1 65.1 67.2 63.9 64.8 66.7 69.1 71.7 75.8

BAROMETRIC PRES: 29.77

FORT

* Fort Bend, Friday, September 1

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.8 80.0 82.2 85.5 89.0 92.9 96.6 100.0 102.2 102.8 102.6
103.6 99.2 88.4 84.7 84.0 84.1 82.7 86.5 84.9 83.7 82.5 81.4 80.3

RELATIVE HUMIDITY: 77.1 78.9 71.8 63.6 52.4 43.9 39.2 33.0 30.4 27.0 28.1 25.0 32.5 53.0
62.8 80.4 69.6 65.9 50.8 53.8 57.2 60.6 63.6 69.3

BAROMETRIC PRES: 29.76

GALV

* Galveston, Friday, September 1

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 81.5 80.4 81.0 83.1 85.8 88.9 91.2 92.7 92.0 91.5 91.3 91.6 91.8
90.4 89.5 89.3 88.3 86.4 85.4 84.2 82.8 81.7 81.1 81.8

RELATIVE HUMIDITY: 91.8 93.6 94.9 87.8 77.1 69.1 72.6 81.7 80.2 76.1 79.8 78.7 81.3 85.8
85.2 82.3 87.1 89.2 80.2 82.8 82.2 88.1 89.8 87.9

BAROMETRIC PRES: 29.76

HARR

* Harris, Friday, September 1

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 80.6 81.2 83.6 87.0 90.4 93.6 96.9 99.8 101.9 103.0 101.8 99.8
91.0 86.8 86.1 85.7 84.8 83.8 86.6 85.3 83.7 82.5 81.5 80.7

RELATIVE HUMIDITY: 74.0 71.5 63.8 56.1 48.7 43.0 38.0 33.4 30.9 31.0 37.8 46.1 57.8 63.6
69.0 68.5 69.9 73.8 59.3 61.2 63.2 66.5 68.6 71.8

BAROMETRIC PRES: 29.74

LIBE

* Liberty, Friday, September 1

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.6 78.1 81.9 86.2 90.2 93.9 96.8 99.3 101.1 101.8 101.3 90.0
85.4 85.1 82.6 81.4 80.8 80.2 84.5 82.5 82.1 80.2 78.4 76.9

RELATIVE HUMIDITY: 71.0 50.0 42.0 37.0 32.0 27.0 23.0 23.0 24.0 22.0 50.0 43.0 50.0 57.0
60.0 61.0 71.0 64.0 51.0 64.0 69.0 71.0 74.0 77.0

BAROMETRIC PRES: 29.53

MONT

* Montgomery, Friday, September 1

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.7 83.2 87.4 92.2 96.2 100.0 102.8 104.1 104.7 104.5 96.3
90.1 87.9 86.1 84.1 82.3 80.0 80.4 87.1 83.1 81.4 79.4 77.9 76.9

RELATIVE HUMIDITY: 71.0 50.0 42.0 37.0 32.0 27.0 23.0 23.0 24.0 22.0 50.0 43.0 50.0 57.0
60.0 61.0 71.0 64.0 51.0 64.0 69.0 71.0 74.0 77.0

BAROMETRIC PRES: 29.53

WALL

* Waller, Friday, September 1

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.7 78.8 83.2 89.9 95.2 98.7 102.4 104.3 106.4 107.8 107.4
104.6 88.0 86.6 87.5 88.2 86.7 85.1 86.9 85.6 83.8 81.9 81.2 80.8

RELATIVE HUMIDITY: 71.0 61.0 48.0 37.0 36.0 30.0 29.0 25.0 25.0 29.0 55.0 67.0 76.0 72.0
82.0 72.0 82.0 82.0 69.0 67.0 67.0 67.0 71.0

BAROMETRIC PRES: 29.64

Saturday, September 2
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Saturday, September 2

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.1 81.8 85.3 88.7 92.4 94.8 97.9 99.1 99.2 98.1 96.9 92.9 89.4
86.3 84.4 83.7 82.9 81.7 83.0 81.6 80.3 80.4 79.2 78.6

RELATIVE HUMIDITY: 95.0 88.0 67.0 57.5 47.0 44.0 35.0 33.5 39.0 38.0 39.5 51.5 58.5 66.5
73.5 76.0 78.0 83.5 85.0 89.5 93.5 93.5 94.0 97.0

BAROMETRIC PRES: 29.77

CHAM

* Chambers, Saturday, September 2

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.0 79.1 83.3 86.3 89.4 92.8 95.8 98.2 100.4 101.2 99.9 97.0
94.6 91.8 89.8 88.2 86.8 85.5 82.0 81.9 81.7 81.9 80.2 79.2

RELATIVE HUMIDITY: 96.8 96.9 93.1 81.8 70.6 59.0 50.3 45.3 41.7 39.1 37.8 40.1 47.6 57.0
63.8 65.0 68.2 75.3 74.0 83.8 86.2 92.8 94.8 95.9

BAROMETRIC PRES: 29.75

FORT

* Fort Bend, Saturday, September 2

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 81.1 81.1 82.3 85.6 89.5 93.1 96.6 99.6 101.7 103.2 103.6 103.9
102.3 99.5 94.8 91.1 88.7 86.7 82.0 81.2 81.8 82.0 81.7 81.4

RELATIVE HUMIDITY: 89.3 89.1 84.5 68.3 53.6 44.8 36.5 32.6 30.2 26.4 25.9 25.7 26.4 32.1
48.7 52.0 57.6 64.2 71.2 71.9 74.9 79.7 84.4 88.2

BAROMETRIC PRES: 29.75

GALV

* Galveston, Saturday, September 2

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 82.6 82.5 83.2 84.3 86.9 89.4 91.7 93.0 93.4 92.6 91.8 90.8 89.8
88.3 86.9 85.9 85.1 84.5 85.7 85.5 84.8 83.3 82.3 82.9

RELATIVE HUMIDITY: 95.7 95.4 90.3 87.4 76.9 64.5 64.9 76.6 79.3 76.7 73.0 77.0 80.2 83.1
84.6 86.1 87.3 85.6 89.9 88.1 91.0 94.5 95.7 95.6

BAROMETRIC PRES: 29.75

HARR

* Harris, Saturday, September 2

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 80.7 81.3 83.5 86.5 89.6 93.2 96.2 98.7 100.3 101.3 100.6 99.8

97.2 94.5 91.3 89.0 87.3 85.8 83.6 83.0 82.5 81.8 81.3 80.8

RELATIVE HUMIDITY: 92.4 88.7 80.7 68.1 57.1 47.8 40.5 35.7 34.0 31.9 36.5 39.5 47.5 49.6

59.4 63.8 65.1 70.4 79.1 83.7 83.8 86.1 89.3 92.4

BAROMETRIC PRES: 29.73

LIBE

* Liberty, Saturday, September 2

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.4 77.2 81.2 84.7 87.3 91.2 95.2 97.7 99.7 100.9 101.0 98.4

96.2 92.1 86.7 85.2 84.3 84.2 80.8 80.7 79.9 79.9 79.2 77.8

RELATIVE HUMIDITY: 82.0 72.0 67.0 61.0 49.0 35.0 31.0 26.0 25.0 25.0 24.0 29.0 37.0 50.0

55.0 46.0 50.0 58.0 64.0 67.0 71.0 67.0 72.0 82.0

BAROMETRIC PRES: 29.52

MONT

* Montgomery, Saturday, September 2

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.4 80.2 82.1 84.8 88.9 95.1 99.1 101.2 103.3 103.9 103.7

101.8 97.9 91.7 88.5 88.5 87.1 84.4 80.2 80.1 79.3 80.6 79.8 77.3

RELATIVE HUMIDITY: 82.0 72.0 67.0 61.0 49.0 35.0 31.0 26.0 25.0 25.0 24.0 29.0 37.0 50.0

55.0 46.0 50.0 58.0 64.0 67.0 71.0 67.0 72.0 82.0

BAROMETRIC PRES: 29.52

WALL

* Waller, Saturday, September 2

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 80.3 80.7 84.0 86.9 91.5 96.1 99.9 102.3 104.5 106.2 107.0

104.6 100.0 96.7 91.6 88.7 87.6 86.3 83.5 85.3 84.1 82.5 81.2 81.1

RELATIVE HUMIDITY: 90.0 79.0 72.0 58.0 48.0 38.0 33.0 30.0 30.0 30.0 35.0 49.0 49.0 48.0

46.0 55.0 61.0 65.0 79.0 85.0 72.0 77.0 82.0 90.0

BAROMETRIC PRES: 29.63

Sunday, September 3
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Sunday, September 3

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.4 81.0 84.8 88.9 92.3 95.3 97.7 99.4 101.8 101.2 99.6 96.0

92.3 89.1 86.9 84.9 83.8 82.3 79.8 79.9 79.8 78.5 78.4 78.2

RELATIVE HUMIDITY: 94.0 80.5 58.5 44.5 39.0 35.5 33.0 30.0 28.5 29.5 37.0 41.5 47.0 56.5
60.5 66.5 69.0 71.5 90.5 91.0 90.0 95.5 95.5 95.5

BAROMETRIC PRES: 29.73

CHAM

* Chambers, Sunday, September 3

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.2 79.9 83.1 86.6 90.3 93.6 96.6 99.1 101.3 103.1 103.9 102.7

100.4 95.3 90.1 89.3 88.9 87.9 84.2 82.9 82.5 82.2 81.2 80.3

RELATIVE HUMIDITY: 89.5 86.6 78.3 65.3 53.7 49.0 43.4 40.6 38.2 36.1 34.6 33.4 33.9 35.7
40.8 57.3 63.0 64.2 83.0 89.5 92.1 93.0 93.4 91.7

BAROMETRIC PRES: 29.71

FORT

* Fort Bend, Sunday, September 3

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.6 79.7 81.8 85.6 89.9 93.8 97.2 100.6 102.4 104.1 105.6

105.5 104.0 101.2 98.0 95.3 91.9 89.0 85.1 84.1 83.1 82.1 81.2 80.3

RELATIVE HUMIDITY: 83.0 78.2 69.7 52.5 38.0 33.2 29.9 28.0 26.7 25.3 23.9 23.3 23.2 25.2
33.6 42.1 44.0 44.7 70.1 73.4 77.8 81.5 82.7 83.0

BAROMETRIC PRES: 29.71

GALV

* Galveston, Sunday, September 3

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 80.7 80.3 80.4 83.1 86.2 89.3 92.3 94.2 95.0 95.0 94.2 93.5 92.1

90.9 88.9 86.2 85.0 85.1 83.6 82.8 82.0 81.5 81.8 81.3

RELATIVE HUMIDITY: 97.4 97.1 93.3 80.8 64.5 54.2 48.3 60.5 72.3 76.3 76.9 74.4 75.4 77.2
78.8 79.3 79.9 81.2 89.4 89.7 90.5 92.0 94.2 95.7

BAROMETRIC PRES: 29.71

HARR

* Harris, Sunday, September 3

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 80.4 80.9 83.2 86.5 90.3 93.6 96.8 99.7 101.6 102.7 103.5 103.3
101.5 99.0 95.4 92.7 90.5 88.9 84.4 83.3 82.4 81.9 81.4 80.8

RELATIVE HUMIDITY: 86.5 77.9 65.6 54.2 43.9 39.4 35.4 31.8 30.0 29.3 27.4 26.8 31.3 38.3
47.5 57.0 58.2 58.9 75.1 79.9 83.3 86.0 86.2 87.3

BAROMETRIC PRES: 29.69

LIBE

* Liberty, Sunday, September 3

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.1 77.5 81.2 85.7 89.7 93.1 96.2 98.8 100.3 102.0 103.1 102.7
99.3 94.2 89.7 87.9 86.2 84.5 83.2 81.8 81.2 80.3 79.0 77.7

RELATIVE HUMIDITY: 69.0 55.0 45.0 39.0 34.0 29.0 27.0 25.5 24.0 21.0 22.0 24.0 29.0 40.0
43.0 46.0 58.0 62.0 59.0 65.0 69.0 74.0 72.0 74.0

BAROMETRIC PRES: 29.48

MONT

* Montgomery, Sunday, September 3

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.6 81.9 86.3 91.4 95.2 98.8 101.0 101.7 103.2 105.2 104.9
103.5 100.9 95.9 92.4 90.5 86.0 83.3 83.9 82.6 80.9 79.8 79.0 77.9

RELATIVE HUMIDITY: 69.0 55.0 45.0 39.0 34.0 29.0 27.0 25.5 24.0 21.0 22.0 24.0 29.0 40.0
43.0 46.0 58.0 62.0 59.0 65.0 69.0 74.0 72.0 74.0

BAROMETRIC PRES: 29.48

WALL

* Waller, Sunday, September 3

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.0 78.9 82.9 87.8 93.0 96.8 100.4 103.0 105.4 107.3 106.3
106.5 104.2 98.7 94.9 91.8 90.5 89.4 85.6 84.1 82.7 81.4 81.0 80.0

RELATIVE HUMIDITY: 88.0 69.0 50.0 43.0 35.0 33.0 32.0 26.0 25.0 27.0 25.0 27.0 35.0 42.0
53.0 59.0 51.0 61.0 69.0 74.0 79.0 82.0 85.0 88.0

BAROMETRIC PRES: 29.59

Monday, September 4
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Monday, September 4

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.8 82.3 86.9 92.0 96.3 100.0 103.3 104.9 105.5 103.1 101.5

97.2 91.9 87.6 84.4 83.0 80.7 80.2 81.0 80.8 79.7 78.9 78.9 78.3

RELATIVE HUMIDITY: 85.0 68.5 50.5 40.0 33.5 29.5 25.5 23.5 25.5 28.0 29.0 43.5 56.0 67.0

73.5 77.5 83.0 86.0 79.5 82.5 86.0 91.0 88.0 88.0

BAROMETRIC PRES: 29.73

CHAM

* Chambers, Monday, September 4

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 80.3 80.5 83.5 88.4 93.7 98.3 101.1 103.5 105.5 105.8 105.4

102.1 96.5 92.8 90.0 87.9 86.2 84.2 86.1 82.7 81.5 81.1 79.0 80.7

RELATIVE HUMIDITY: 78.8 75.6 67.3 56.4 47.9 42.9 37.6 33.1 29.9 29.6 30.9 33.1 38.7 45.1

52.9 59.2 63.4 66.6 62.8 62.8 69.5 78.5 84.3 83.4

BAROMETRIC PRES: 29.72

FORT

* Fort Bend, Monday, September 4

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 79.3 79.2 82.3 87.7 92.8 97.7 101.6 105.3 107.3 108.6 108.6

107.6 104.8 101.3 97.1 93.5 90.9 89.0 86.7 84.8 83.7 82.3 81.2 80.1

RELATIVE HUMIDITY: 76.7 75.0 63.4 49.2 38.2 30.4 26.4 21.4 20.1 16.9 18.0 20.0 22.9 27.0

35.9 42.7 48.7 53.0 50.3 55.8 59.5 66.3 71.0 75.0

BAROMETRIC PRES: 29.71

GALV

* Galveston, Monday, September 4

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.6 78.5 80.1 83.8 88.4 92.8 95.6 97.5 96.0 96.7 96.7 95.1 92.9

90.9 89.4 89.0 88.0 86.6 84.3 83.9 83.0 81.6 80.5 79.6

RELATIVE HUMIDITY: 96.2 93.3 86.3 75.6 62.7 51.8 44.6 37.8 63.0 68.6 70.1 78.0 82.7 87.8

86.9 86.5 87.5 90.3 82.8 87.4 90.4 91.2 94.5 96.6

BAROMETRIC PRES: 29.71

HARR

* Harris, Monday, September 4

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 80.8 81.6 84.9 89.7 94.4 98.8 102.1 104.2 105.6 105.8 105.6

104.0 100.8 97.2 94.1 91.2 89.1 87.4 87.5 85.7 83.9 82.2 81.3 80.8

RELATIVE HUMIDITY: 76.3 67.6 55.5 44.6 36.2 30.7 27.2 24.0 22.5 23.1 24.1 27.3 33.3 40.8
46.6 52.3 57.7 62.1 60.4 64.6 70.6 74.9 76.1 77.3

BAROMETRIC PRES: 29.69

LIBE

* Liberty, Monday, September 4

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.6 77.1 80.7 87.4 92.9 97.2 100.4 102.8 104.6 104.8 104.9

103.2 98.8 94.8 90.6 88.1 85.7 83.5 82.6 81.0 81.4 79.9 78.1 77.9

RELATIVE HUMIDITY: 79.0 53.0 35.0 29.0 24.0 19.0 19.0 19.0 18.0 19.0 19.0 21.0 29.0 43.0
45.0 53.0 55.0 58.0 71.0 67.0 76.0 79.0 81.0 84.0

BAROMETRIC PRES: 29.49

MONT

* Montgomery, Monday, September 4

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.0 81.5 88.6 95.7 100.6 103.7 106.1 107.6 108.0 107.9 107.8

106.7 102.2 96.1 92.4 88.8 86.4 84.5 80.2 81.2 79.9 78.1 75.9 75.0

RELATIVE HUMIDITY: 79.0 53.0 35.0 29.0 24.0 19.0 19.0 19.0 18.0 19.0 19.0 21.0 29.0 43.0
45.0 53.0 55.0 58.0 71.0 67.0 76.0 79.0 81.0 84.0

BAROMETRIC PRES: 29.49

WALL

* Waller, Monday, September 4

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 78.2 78.1 82.9 91.5 98.4 103.5 107.0 108.8 110.8 111.5 111.0

110.1 107.8 104.0 99.1 96.1 93.1 89.4 88.4 85.5 84.5 82.1 81.1 79.6

RELATIVE HUMIDITY: 82.0 61.0 40.0 30.0 24.0 21.0 21.0 19.0 18.0 21.0 21.0 24.0 31.0 45.0
48.0 53.0 62.0 67.0 63.0 69.0 71.0 74.0 74.0 79.0

BAROMETRIC PRES: 29.59

Tuesday, September 5
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Tuesday, September 5

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.9 80.4 83.3 93.5 97.2 101.5 103.3 103.7 102.0 100.5 94.4

89.5 85.7 84.1 82.3 80.9 79.9 79.9 78.8 79.0 77.9 78.1 77.7 76.5

RELATIVE HUMIDITY: 96.0 #DIV/0! #DIV/0! 34.0 31.0 27.0 27.0 26.5 32.5 35.0 57.0 72.0

72.0 74.5 81.0 87.5 89.0 77.5 89.5 90.5 92.5 92.5 94.0 95.0

BAROMETRIC PRES: 29.74

CHAM

* Chambers, Tuesday, September 5

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.3 76.1 82.1 88.3 94.4 98.5 101.2 102.9 104.2 102.3 90.4 96.9

97.7 92.6 87.3 85.4 83.2 81.3 81.9 80.3 78.7 77.7 77.2 76.2

RELATIVE HUMIDITY: 77.9 80.0 72.1 59.8 52.1 39.5 36.1 35.0 34.9 34.7 45.4 50.2 48.4 57.6

62.9 62.0 52.1 50.0 69.1 71.5 74.0 74.6 74.4 75.1

BAROMETRIC PRES: 29.74

FORT

* Fort Bend, Tuesday, September 5

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 81.3 81.4 85.5 91.1 96.6 101.1 103.4 105.1 106.1 106.5 103.6

100.1 99.3 94.6 91.5 89.0 87.6 88.0 87.2 85.6 84.1 83.3 82.5 81.9

RELATIVE HUMIDITY: 66.4 65.5 58.5 44.0 32.2 25.9 24.7 24.2 23.5 22.6 24.9 33.0 34.7 42.4

46.9 53.1 52.3 34.9 58.5 60.6 64.8 65.3 66.8 68.6

BAROMETRIC PRES: 29.72

GALV

* Galveston, Tuesday, September 5

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 81.6 81.9 84.5 88.0 89.8 91.2 93.6 96.4 98.8 100.4 100.1 95.6

93.9 93.3 90.8 88.2 87.3 87.1 86.2 85.1 84.0 83.1 82.4 82.0

RELATIVE HUMIDITY: 82.7 77.0 68.2 62.1 68.5 54.8 45.4 42.0 34.8 33.2 43.9 62.3 60.9 62.1

71.6 74.5 76.7 72.9 92.9 92.3 92.8 87.0 89.4 88.1

BAROMETRIC PRES: 29.72

HARR

* Harris, Tuesday, September 5

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 80.9 81.9 85.9 90.6 95.0 98.9 101.4 103.0 103.9 103.7 99.2 98.1
97.6 94.8 92.1 90.4 89.2 88.1 85.9 84.4 83.2 82.1 81.6 81.2

RELATIVE HUMIDITY: 78.4 70.2 58.5 46.4 36.9 30.9 28.2 27.3 27.6 31.1 34.2 38.7 40.5 45.8
49.0 48.9 46.6 43.2 68.3 70.7 73.3 74.6 76.1 77.7

BAROMETRIC PRES: 29.71

LIBE

* Liberty, Tuesday, September 5

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.6 76.2 81.8 88.7 94.1 97.7 99.7 101.3 102.4 101.2 97.7 100.0
98.8 95.1 90.7 88.3 86.4 84.2 81.5 80.0 78.5 77.6 76.9 76.1

RELATIVE HUMIDITY: 76.0 51.0 38.0 30.0 24.0 25.0 23.0 28.0 27.0 27.0 28.0 26.0 29.0 35.0
39.0 43.0 45.0 44.0 67.0 69.0 74.0 76.0 81.0 81.0

BAROMETRIC PRES: 29.51

MONT

* Montgomery, Tuesday, September 5

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.3 81.3 88.2 95.0 99.8 102.2 104.0 103.3 103.8 103.7 102.3
101.6 98.7 94.8 91.8 88.9 87.4 85.4 80.8 79.3 77.3 76.1 75.1 74.6

RELATIVE HUMIDITY: 76.0 51.0 38.0 30.0 24.0 25.0 23.0 28.0 27.0 27.0 28.0 26.0 29.0 35.0
39.0 43.0 45.0 44.0 67.0 69.0 74.0 76.0 81.0 81.0

BAROMETRIC PRES: 29.51

WALL

* Waller, Tuesday, September 5

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.8 78.2 84.8 93.2 99.9 103.4 105.4 107.0 107.7 107.1 106.9
105.4 104.8 101.9 97.9 96.0 93.8 91.1 87.0 83.6 81.4 80.4 79.2 78.3

RELATIVE HUMIDITY: 85.0 63.0 46.0 30.0 25.0 25.0 24.0 23.0 25.0 26.0 29.0 30.0 35.0 36.0
37.0 41.0 43.0 42.0 79.0 74.0 77.0 82.0 84.0 84.0

BAROMETRIC PRES: 29.61

Wednesday, September 6
Eight-County Houston/Galveston Nonattainment Area

BRAZ

* Brazoria, Wednesday, September 6

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 73.7 75.7 78.1 81.1 83.4 86.2 88.2 89.8 90.4 89.8 88.7 87.2 84.3
82.6 82.2 80.3 78.2 77.4 79.9 80.6 79.5 77.2 75.8 74.1

RELATIVE HUMIDITY: 73.5 67.5 67.0 60.5 58.0 54.0 50.5 48.5 50.0 51.5 54.5 58.5 68.5 75.5
76.5 83.0 89.5 92.5 71.5 61.5 63.0 66.5 69.0 73.5

BAROMETRIC PRES: 29.75

CHAM

* Chambers, Wednesday, September 6

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 69.3 69.1 72.2 76.5 80.6 84.4 87.6 90.2 91.7 92.6 92.7 90.6 88.4
86.1 84.5 83.5 81.1 78.8 81.2 78.6 78.0 75.3 71.7 70.7

RELATIVE HUMIDITY: 76.2 81.1 81.7 78.2 72.8 68.8 64.8 60.6 57.7 54.1 53.3 56.6 58.4 62.8
71.1 79.6 82.7 84.7 48.5 51.7 56.1 58.9 65.9 70.8

BAROMETRIC PRES: 29.75

FORT

* Fort Bend, Wednesday, September 6

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 76.6 75.6 76.5 78.5 81.8 85.1 88.0 90.4 92.4 94.0 95.0 94.8 93.5
91.4 88.5 85.6 83.6 82.1 86.6 86.0 84.6 82.9 80.7 78.3

RELATIVE HUMIDITY: 59.8 64.8 67.0 64.5 59.3 54.5 50.0 46.8 42.6 36.8 35.4 36.2 40.5 47.1
53.2 66.3 73.8 76.9 34.1 34.3 38.1 43.0 49.5 53.8

BAROMETRIC PRES: 29.74

GALV

* Galveston, Wednesday, September 6

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 77.4 76.3 75.8 76.3 77.6 79.5 82.2 83.9 84.7 85.2 85.7 85.9 85.7
85.1 84.8 84.7 84.2 83.8 88.2 88.1 86.2 83.5 80.8 78.9

RELATIVE HUMIDITY: 77.3 80.8 82.0 81.0 79.2 79.0 76.1 74.8 76.6 76.1 74.0 74.8 76.5 78.3
79.1 79.3 79.2 81.7 57.6 54.5 57.6 61.2 67.5 73.2

BAROMETRIC PRES: 29.74

HARR

* Harris, Wednesday, September 6

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 74.5 74.0 75.2 77.6 80.7 83.7 86.5 89.2 91.0 92.2 92.5 91.7 90.5
88.3 86.5 84.8 83.4 82.3 86.8 84.8 82.6 80.2 77.9 75.9

RELATIVE HUMIDITY: 69.9 71.4 69.9 66.1 60.9 56.5 52.0 46.9 44.7 42.6 42.6 44.1 47.6 56.2
63.3 72.4 76.9 79.8 42.4 44.8 49.2 54.6 60.1 65.7

BAROMETRIC PRES: 29.73

LIBE

* Liberty, Wednesday, September 6

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 69.4 69.1 72.2 76.0 79.7 83.1 86.4 89.3 91.0 91.9 92.5 92.3 89.8
87.4 84.9 83.3 81.9 80.5 83.3 80.8 78.4 75.5 72.9 71.0

RELATIVE HUMIDITY: 76.0 67.0 62.0 55.0 51.0 44.0 37.0 34.0 36.0 34.0 35.0 33.0 38.0 51.0
48.0 51.0 56.0 66.0 41.0 44.0 52.0 62.0 73.0 78.0

BAROMETRIC PRES: 29.53

MONT

* Montgomery, Wednesday, September 6

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 70.5 72.7 75.9 79.7 82.9 86.5 89.4 93.1 93.5 94.4 93.5 93.3 91.6
87.3 86.6 84.5 82.4 79.6 83.8 81.9 79.0 75.7 71.9 69.4

RELATIVE HUMIDITY: 76.0 67.0 62.0 55.0 51.0 44.0 37.0 34.0 36.0 34.0 35.0 33.0 38.0 51.0
48.0 51.0 56.0 66.0 41.0 44.0 52.0 62.0 73.0 78.0

BAROMETRIC PRES: 29.53

WALL

* Waller, Wednesday, September 6

SUNRISE/SUNSET: 7 8

HOURLY TEMPERATURES: 75.2 74.2 76.9 79.9 83.3 86.8 90.4 93.0 94.8 96.8 97.3 97.3 96.0
93.1 90.2 87.0 86.9 84.3 88.2 87.6 85.1 82.3 79.5 77.2

RELATIVE HUMIDITY: 71.0 69.0 62.0 57.0 50.0 45.0 38.0 34.0 34.0 32.0 36.0 36.0 43.0 58.0
50.0 63.0 74.0 79.0 43.0 45.0 50.0 58.0 62.0 66.0

BAROMETRIC PRES: 29.63

APPENDIX F
MOBILE6 REGISTRATION DISTRIBUTIONS AND
DIESEL FRACTIONS INPUT

Harris County MOBILE6 Registration Distributions* Input

*	LDV
1	0.07627 0.09320 0.09265 0.08016 0.07495 0.07056 0.06405 0.06924 0.05598 0.05293 0.04619 0.04286 0.03761 0.03116 0.02468 0.01822 0.01479 0.01283 0.00962 0.00557 0.00414 0.00301 0.00224 0.00283 0.01426
*	LDT1
2	0.08992 0.09872 0.08913 0.07863 0.07599 0.07446 0.05400 0.06141 0.06026 0.04917 0.04024 0.03446 0.02894 0.02839 0.02315 0.01653 0.01649 0.01535 0.01317 0.00749 0.00886 0.00667 0.00338 0.00457 0.02062
*	LDT2
3	0.08992 0.09872 0.08913 0.07863 0.07599 0.07446 0.05400 0.06141 0.06026 0.04917 0.04024 0.03446 0.02894 0.02839 0.02315 0.01653 0.01649 0.01535 0.01317 0.00749 0.00886 0.00667 0.00338 0.00457 0.02062
*	LDT3
4	0.14705 0.18227 0.12654 0.14564 0.05791 0.07428 0.04776 0.04732 0.02870 0.02556 0.01903 0.01517 0.01247 0.01181 0.00922 0.00512 0.00687 0.00692 0.00667 0.00370 0.00445 0.00225 0.00184 0.00314 0.00831
*	LDT4
5	0.14705 0.18227 0.12654 0.14564 0.05791 0.07428 0.04776 0.04732 0.02870 0.02556 0.01903 0.01517 0.01247 0.01181 0.00922 0.00512 0.00687 0.00692 0.00667 0.00370 0.00445 0.00225 0.00184 0.00314 0.00831
*	HDV2
6	0.12134 0.14320 0.14418 0.09409 0.06247 0.08917 0.04199 0.05866 0.03300 0.03881 0.02518 0.01958 0.01916 0.01557 0.01515 0.01079 0.00962 0.01031 0.00920 0.00540 0.00809 0.00657 0.00415 0.00422 0.01010
*	HDV3
7	0.05725 0.10687 0.12463 0.13621 0.03641 0.08177 0.04712 0.08353 0.07707 0.04727 0.03479 0.02760 0.02877 0.02026 0.02143 0.01057 0.00940 0.00984 0.00558 0.00338 0.00426 0.00455 0.00206 0.00411 0.01527
*	HDV4
8	0.07671 0.10750 0.15192 0.14151 0.05437 0.08764 0.08069 0.09186 0.04345 0.03128 0.02507 0.01639 0.01887 0.01216 0.00968 0.00497 0.00472 0.00472 0.00521 0.00223 0.00273 0.00223 0.00149 0.00497 0.01763
*	HDV5
9	0.07132 0.11904 0.15199 0.16725 0.04919 0.05558 0.03591 0.04624 0.03246 0.02459 0.02804 0.02115 0.02656 0.01869 0.01820 0.02558 0.01918 0.00984 0.01230 0.00492 0.01131 0.01131 0.00492 0.00836 0.02607
*	HDV6
10	0.04610 0.09757 0.11178 0.12425 0.08699 0.05968 0.04721 0.08036 0.03915 0.04547 0.02984 0.03363 0.03836 0.02479 0.01973 0.02005 0.01326 0.01468 0.01121 0.00710 0.01074 0.00868 0.00474 0.00774 0.01689
*	HDV7
11	0.04499 0.06915 0.09025 0.10442 0.07331 0.07220 0.06665 0.09331 0.04610 0.03582 0.03804 0.05554 0.04749 0.03082 0.02333 0.01805 0.01805 0.01666 0.01389 0.00694 0.00583 0.00778 0.00444 0.00639 0.01055
*	HDV8
12	0.03887 0.04238 0.05786 0.05575 0.04608 0.03271 0.04784 0.07247 0.05997 0.05628 0.04696 0.05522 0.05610 0.06068 0.04836 0.03324 0.02638 0.02919 0.02656 0.00827 0.01688 0.01653 0.01600 0.01847 0.03095
*	HDV8
13	0.07006 0.07188 0.10464 0.14010 0.05551 0.05369 0.02275 0.09190 0.03913 0.07279 0.02457 0.04641 0.04641 0.05096 0.02912 0.02002 0.00910 0.00910 0.01274 0.00273 0.00910 0.00273 0.00273 0.00546 0.00637
*	HDBS is MOBILE6 default
*	HDBT is MOBILE6 default
*	MC
16	0.13399 0.14595 0.11404 0.09350 0.06670 0.05159 0.04948 0.04329 0.03351 0.03109 0.01874 0.01266 0.01314 0.01224 0.01245 0.01069 0.02026 0.01566 0.01279 0.01407 0.01781 0.01151 0.01117 0.00927 0.04440

* Based on TxDOT mid-year 2002 county registration data.

Urban Counties Group MOBILE6 Registration Distributions* Input

LDV											
1	0.05901	0.08828	0.10154	0.08910	0.08067	0.07496	0.06750	0.07121	0.05741	0.05349	
	0.04384	0.04045	0.03430	0.02921	0.02207	0.01676	0.01393	0.01234	0.00946	0.00550	
	0.00403	0.00305	0.00239	0.00286	0.01664						
* LDT1											
2	0.07718	0.10021	0.09169	0.07866	0.07558	0.07268	0.05480	0.06133	0.05987	0.04714	
	0.03961	0.03646	0.03227	0.02986	0.02425	0.01710	0.01782	0.01583	0.01475	0.00799	
	0.00882	0.00694	0.00327	0.00489	0.02100						
* LDT2											
3	0.07718	0.10021	0.09169	0.07866	0.07558	0.07268	0.05480	0.06133	0.05987	0.04714	
	0.03961	0.03646	0.03227	0.02986	0.02425	0.01710	0.01782	0.01583	0.01475	0.00799	
	0.00882	0.00694	0.00327	0.00489	0.02100						
* LDT3											
4	0.12332	0.17360	0.12291	0.14709	0.05363	0.07861	0.05594	0.04937	0.03393	0.02970	
	0.02179	0.01733	0.01330	0.01372	0.01009	0.00559	0.00886	0.00835	0.00807	0.00453	
	0.00495	0.00226	0.00185	0.00303	0.00818						
* LDT4											
5	0.12332	0.17360	0.12291	0.14709	0.05363	0.07861	0.05594	0.04937	0.03393	0.02970	
	0.02179	0.01733	0.01330	0.01372	0.01009	0.00559	0.00886	0.00835	0.00807	0.00453	
	0.00495	0.00226	0.00185	0.00303	0.00818						
* HDV2											
6	0.15671	0.20324	0.15061	0.11260	0.06321	0.06789	0.02947	0.03638	0.02033	0.01565	
	0.01423	0.01382	0.01240	0.01362	0.01260	0.00752	0.01016	0.00955	0.00996	0.00549	
	0.00772	0.00610	0.00346	0.00427	0.01301						
* HDV3											
7	0.04664	0.09950	0.11754	0.12188	0.03296	0.09266	0.03296	0.06654	0.05784	0.04229	
	0.03794	0.03980	0.03234	0.03109	0.01990	0.01182	0.01306	0.01555	0.00933	0.00684	
	0.00995	0.00871	0.00560	0.00622	0.04104						
* HDV4											
8	0.02397	0.08733	0.13357	0.09589	0.04966	0.13014	0.06507	0.06164	0.03938	0.04110	
	0.03253	0.03767	0.03767	0.03767	0.02055	0.00685	0.00856	0.00514	0.00514	0.01027	
	0.01370	0.01027	0.00342	0.00514	0.03767						
* HDV5											
9	0.05934	0.09670	0.12088	0.16045	0.03736	0.04176	0.03077	0.04176	0.02637	0.01538	
	0.01758	0.03516	0.01978	0.02198	0.02857	0.01978	0.01758	0.02418	0.01758	0.02418	
	0.01319	0.01978	0.01099	0.01978	0.07912						
* HDV6											
10	0.01738	0.04605	0.05995	0.07643	0.05908	0.03910	0.03649	0.06690	0.03215	0.05908	
	0.04605	0.04170	0.05300	0.04170	0.03997	0.02954	0.03910	0.03301	0.03475	0.02172	
	0.02520	0.02346	0.01390	0.01564	0.04865						
* HDV7											
11	0.01806	0.05255	0.08705	0.08046	0.05747	0.03612	0.05747	0.06897	0.04433	0.04926	
	0.05911	0.06240	0.05419	0.03612	0.02627	0.02627	0.01314	0.01970	0.03284	0.00985	
	0.00657	0.02791	0.01642	0.01642	0.04105						
* HDV8A											
12	0.00860	0.02033	0.04144	0.03753	0.03675	0.02580	0.03597	0.05238	0.06802	0.05160	
	0.04222	0.06177	0.06255	0.06255	0.06020	0.04378	0.03206	0.04378	0.04222	0.01251	
	0.02267	0.02737	0.03440	0.01955	0.05395						
* HDV8B											
13	0.05405	0.15946	0.12432	0.17840	0.07568	0.09459	0.01351	0.09730	0.03514	0.02973	
	0.02162	0.02432	0.02162	0.02432	0.01081	0.01081	0.01351	0.00811	0.00270	0.00000	
	0.00000	0.00000	0.00000	0.00000	0.00000						
* HDBS is MOBILE6 default											
* HDBT is MOBILE6 default											
* MC											
16	0.11897	0.13833	0.11082	0.09125	0.06599	0.04798	0.04963	0.03895	0.03580	0.02882	
	0.01800	0.01390	0.01622	0.01479	0.01198	0.01362	0.02184	0.01937	0.01458	0.01677	
	0.01985	0.01376	0.01458	0.01095	0.05325						

* Based on TxDOT mid-year 2002 Brazoria, Fort Bend, Galveston, Montgomery counties aggregate registration data.

Rural Counties Group MOBILE6 Registration Distributions* Input

*	LDV										
1		0.04066	0.07147	0.08973	0.07903	0.07295	0.06828	0.06220	0.06720	0.05621	0.05643
		0.04667	0.04683	0.04160	0.03830	0.03144	0.02479	0.02019	0.01941	0.01524	0.00938
		0.00664	0.00471	0.00357	0.00521	0.02186					
*	LDT1										
2		0.06160	0.08639	0.07987	0.07048	0.07286	0.07241	0.05405	0.06108	0.06169	0.04707
		0.04273	0.04001	0.03463	0.03324	0.02905	0.01945	0.01993	0.01929	0.01896	0.01232
		0.01265	0.00996	0.00453	0.00749	0.02826					
*	LDT2										
3		0.06160	0.08639	0.07987	0.07048	0.07286	0.07241	0.05405	0.06108	0.06169	0.04707
		0.04273	0.04001	0.03463	0.03324	0.02905	0.01945	0.01993	0.01929	0.01896	0.01232
		0.01265	0.00996	0.00453	0.00749	0.02826					
*	LDT3										
4		0.10549	0.15333	0.11104	0.13344	0.05808	0.08927	0.06478	0.05892	0.03663	0.03548
		0.02365	0.01832	0.01486	0.01518	0.01109	0.00607	0.01162	0.01172	0.01109	0.00628
		0.00534	0.00429	0.00230	0.00419	0.00754					
*	LDT4										
5		0.10549	0.15333	0.11104	0.13344	0.05808	0.08927	0.06478	0.05892	0.03663	0.03548
		0.02365	0.01832	0.01486	0.01518	0.01109	0.00607	0.01162	0.01172	0.01109	0.00628
		0.00534	0.00429	0.00230	0.00419	0.00754					
*	HDV2										
6		0.18166	0.21311	0.11703	0.15284	0.08821	0.05415	0.02271	0.02707	0.01397	0.00961
		0.00873	0.02358	0.00873	0.00611	0.00611	0.00699	0.01048	0.00786	0.00961	0.00262
		0.00786	0.00262	0.00524	0.00349	0.00961					
*	HDV3										
7		0.06589	0.12403	0.09690	0.13565	0.06202	0.04651	0.05039	0.08140	0.05039	0.03101
		0.02713	0.03101	0.03488	0.01938	0.04264	0.01550	0.00000	0.01550	0.01163	0.00775
		0.00000	0.01163	0.00000	0.00775	0.03101					
*	HDV4										
8		0.04396	0.13187	0.14283	0.09890	0.01099	0.12088	0.07692	0.04396	0.02198	0.04396
		0.02198	0.03297	0.02198	0.02198	0.02198	0.00000	0.00000	0.04396	0.01099	0.00000
		0.00000	0.01099	0.00000	0.00000	0.07692					
*	HDV5										
9		0.01515	0.15153	0.06061	0.07576	0.04545	0.06061	0.07576	0.04545	0.01515	0.01515
		0.03030	0.06061	0.03030	0.06061	0.01515	0.00000	0.03030	0.01515	0.01515	0.03030
		0.03030	0.01515	0.01515	0.00000	0.09091					
*	HDV6										
10		0.01826	0.03653	0.10504	0.08676	0.05479	0.01370	0.03653	0.05023	0.03196	0.05023
		0.04566	0.04110	0.05936	0.04110	0.03196	0.02740	0.05479	0.03196	0.01370	0.00913
		0.03653	0.01826	0.01826	0.02283	0.06393					
*	HDV7										
11		0.02000	0.08000	0.06000	0.07000	0.09000	0.06000	0.04000	0.06000	0.05000	0.04000
		0.04000	0.05000	0.06000	0.06000	0.02000	0.02000	0.01000	0.02000	0.03000	0.02000
		0.02000	0.02000	0.02000	0.03000	0.01000					
*	HDV8										
12		0.01087	0.01087	0.03261	0.03804	0.01630	0.02174	0.01087	0.03261	0.07066	0.05978
		0.05435	0.05978	0.05435	0.06522	0.05978	0.04348	0.01630	0.06522	0.05435	0.02717
		0.02174	0.05435	0.03261	0.03804	0.04891					
*	HDV8										
13		0.00361	0.09386	0.09025	0.00722	0.15162	0.11552	0.11191	0.09025	0.22385	0.07581
		0.01444	0.00000	0.00000	0.00000	0.00722	0.00361	0.00000	0.00000	0.00000	0.00000
		0.00000	0.00722	0.00000	0.00361	0.00000					
*	HDBS is MOBILE6 default										
*	HDBT is MOBILE6 default										
*	MC										
16		0.09953	0.12960	0.11957	0.09552	0.06747	0.05010	0.05878	0.04743	0.03407	0.03407
		0.01737	0.01202	0.01269	0.01470	0.01670	0.01069	0.01670	0.02338	0.01536	0.01670
		0.02004	0.01737	0.01403	0.01002	0.04609					

* Based on TxDOT mid-year 2002 Chamber, Liberty, Waller counties aggregate registration data.

2000 Diesel Fractions MOBILE6 Input*

DIESEL FRACTIONS :									
0.00090	0.00090	0.00090	0.00090	0.00090	0.00060	0.00010	0.00030	0.00060	0.00130
0.00040	0.00040	0.00010	0.00270	0.00320	0.00970	0.01620	0.02410	0.05100	0.07060
0.03900	0.02690	0.01140	0.00930	0.01370					
0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00000	0.00000	0.00000	0.00070	0.00330	0.00480	0.01200	0.02230	0.06560	0.06160
0.04390	0.03160	0.02590	0.00000	0.01870					
0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.00000	0.00000	0.00000	0.00070	0.00330	0.00480	0.01200	0.02230	0.06560	0.06160
0.04390	0.03160	0.02590	0.00000	0.01870					
0.01260	0.01260	0.01260	0.01260	0.01260	0.01150	0.01110	0.01450	0.01150	0.01290
0.00960	0.00830	0.00720	0.00820	0.01240	0.01350	0.01690	0.02090	0.02560	0.00130
0.00060	0.00110	0.00010	0.00000	0.00000					
0.01260	0.01260	0.01260	0.01260	0.01260	0.01150	0.01110	0.01450	0.01150	0.01290
0.00960	0.00830	0.00720	0.00820	0.01240	0.01350	0.01690	0.02090	0.02560	0.00130
0.00060	0.00110	0.00010	0.00000	0.00000					
0.61397	0.66232	0.57703	0.47784	0.45121	0.20063	0.39808	0.37552	0.32844	0.35352
0.27226	0.22309	0.17730	0.14483	0.20196	0.17056	0.19074	0.17148	0.14044	0.00323
0.00000	0.00382	0.00303	0.00303	0.00303					
0.65615	0.64013	0.51450	0.57439	0.54389	0.32661	0.55020	0.58601	0.62333	0.51890
0.51653	0.46856	0.35294	0.25512	0.29752	0.17664	0.22368	0.21759	0.16066	0.03297
0.01508	0.00373	0.00406	0.00406	0.00406					
0.72152	0.63857	0.67967	0.73075	0.66667	0.44671	0.70203	0.69632	0.65581	0.65789
0.57317	0.60350	0.35745	0.24855	0.13542	0.12313	0.18852	0.13253	0.17797	0.14583
0.05000	0.03185	0.01034	0.01034	0.01034					
0.89367	0.88016	0.75422	0.72991	0.80476	0.45659	0.67857	0.72535	0.65432	0.70483
0.60383	0.59509	0.41699	0.33654	0.25337	0.30960	0.25418	0.28244	0.20767	0.23790
0.14394	0.12340	0.03350	0.03350	0.03350					
0.86671	0.86169	0.81933	0.74312	0.78239	0.54923	0.77170	0.75818	0.57117	0.66954
0.72241	0.69427	0.56318	0.62198	0.54717	0.46968	0.43758	0.40440	0.37461	0.43137
0.18953	0.14992	0.04644	0.04644	0.04644					
0.90479	0.88593	0.84672	0.75646	0.81899	0.48829	0.82916	0.84387	0.84789	0.85788
0.83389	0.82784	0.81143	0.81176	0.78571	0.74359	0.73051	0.70909	0.63052	0.70608
0.36715	0.27615	0.20888	0.20888	0.20888					
0.93355	0.94685	0.94189	0.86917	0.90694	0.67588	0.96360	0.95187	0.94895	0.93046
0.94083	0.94469	0.95000	0.94092	0.91551	0.91340	0.92834	0.91875	0.91908	0.88970
0.56726	0.56641	0.55152	0.55152	0.55152					
0.99167	0.98288	0.98189	0.95390	0.99119	0.78746	0.96058	0.98670	0.96262	1.00000
0.95333	0.97500	0.95238	0.92424	0.92958	0.98969	0.95455	0.97143	0.94286	0.96296
0.40000	0.44444	0.51064	0.51064	0.51064					
0.95850	0.95850	0.95850	0.95850	0.95850	0.88570	0.85250	0.87950	0.99000	0.91050
0.87600	0.77100	0.75020	0.73450	0.67330	0.51550	0.38450	0.32380	0.32600	0.26390
0.05940	0.04600	0.02910	0.02400	0.00860					

* Based on TxDOT Stateswide mid-year 2002 county registration data except EPA fractions are used for LDV, LDT and Bus.

APPENDIX G
MOBILE6 VMT BY HOUR INPUT

County-Level, Weekday 2000 Hourly VMT Fractions Input to MOBILE6

Hour	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
7	0.05585	0.05863	0.05206	0.04292	0.05507	0.05124	0.04361	0.05448
8	0.07463	0.07437	0.06951	0.05525	0.07045	0.06482	0.05571	0.06917
9	0.09800	0.09639	0.09260	0.07082	0.09044	0.08286	0.07130	0.09001
10	0.04242	0.04469	0.04336	0.04858	0.04429	0.04634	0.04740	0.04773
11	0.05027	0.05147	0.05091	0.05620	0.05144	0.05330	0.05515	0.05495
12	0.05637	0.05516	0.05576	0.05989	0.05552	0.05676	0.05885	0.05915
13	0.05928	0.05584	0.05753	0.06007	0.05646	0.05685	0.05902	0.06067
14	0.05962	0.05567	0.05771	0.05976	0.05634	0.05646	0.05886	0.06074
15	0.05940	0.05499	0.05705	0.05863	0.05562	0.05558	0.05770	0.06015
16	0.08082	0.08012	0.08041	0.07685	0.07963	0.07857	0.07707	0.07978
17	0.07972	0.08043	0.08031	0.07810	0.08026	0.07977	0.07823	0.07906
18	0.07902	0.08111	0.08030	0.07756	0.08026	0.07987	0.07750	0.08035
19	0.07442	0.07527	0.07492	0.07202	0.07470	0.07419	0.07170	0.07457
20	0.02535	0.02788	0.03007	0.03797	0.03048	0.03380	0.03903	0.02600
21	0.02183	0.02285	0.02513	0.03057	0.02497	0.02728	0.03142	0.02165
22	0.01962	0.02047	0.02234	0.02782	0.02252	0.02472	0.02863	0.01915
23	0.01682	0.01653	0.01830	0.02217	0.01827	0.01969	0.02285	0.01586
24	0.01359	0.01278	0.01447	0.01696	0.01425	0.01506	0.01736	0.01249
1	0.00904	0.00882	0.00981	0.01177	0.00987	0.01046	0.01186	0.00872
2	0.00620	0.00584	0.00660	0.00758	0.00649	0.00678	0.00761	0.00588
3	0.00524	0.00462	0.00528	0.00605	0.00522	0.00538	0.00610	0.00467
4	0.00331	0.00341	0.00369	0.00477	0.00387	0.00420	0.00483	0.00326
5	0.00325	0.00418	0.00408	0.00598	0.00461	0.00533	0.00612	0.00380
6	0.00594	0.00848	0.00780	0.01171	0.00897	0.01069	0.01209	0.00771
Total	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

County-Level, Friday 2000 Hourly VMT Fractions Input to MOBILE6

Hour	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
7	0.05585	0.05863	0.05206	0.04292	0.05507	0.05124	0.04361	0.05448
8	0.07463	0.07437	0.06951	0.05525	0.07045	0.06482	0.05571	0.06917
9	0.09800	0.09639	0.09260	0.07082	0.09044	0.08286	0.07130	0.09001
10	0.04242	0.04469	0.04336	0.04858	0.04429	0.04634	0.04740	0.04773
11	0.05027	0.05147	0.05091	0.05620	0.05144	0.05330	0.05515	0.05495
12	0.05637	0.05516	0.05576	0.05989	0.05552	0.05676	0.05885	0.05915
13	0.05928	0.05584	0.05753	0.06007	0.05646	0.05685	0.05902	0.06067
14	0.05962	0.05567	0.05771	0.05976	0.05634	0.05646	0.05886	0.06074
15	0.05940	0.05499	0.05705	0.05863	0.05562	0.05558	0.05770	0.06015
16	0.08082	0.08012	0.08041	0.07685	0.07963	0.07857	0.07707	0.07978
17	0.07972	0.08043	0.08031	0.07810	0.08026	0.07977	0.07823	0.07906
18	0.07902	0.08111	0.08030	0.07756	0.08026	0.07987	0.07750	0.08035
19	0.07442	0.07527	0.07492	0.07202	0.07470	0.07419	0.07170	0.07457
20	0.02535	0.02788	0.03007	0.03797	0.03048	0.03380	0.03903	0.02600
21	0.02183	0.02285	0.02513	0.03057	0.02497	0.02728	0.03142	0.02165
22	0.01962	0.02047	0.02234	0.02782	0.02252	0.02472	0.02863	0.01915
23	0.01682	0.01653	0.01830	0.02217	0.01827	0.01969	0.02285	0.01586
24	0.01359	0.01278	0.01447	0.01696	0.01425	0.01506	0.01736	0.01249
1	0.00904	0.00882	0.00981	0.01177	0.00987	0.01046	0.01186	0.00872
2	0.00620	0.00584	0.00660	0.00758	0.00649	0.00678	0.00761	0.00588
3	0.00524	0.00462	0.00528	0.00605	0.00522	0.00538	0.00610	0.00467
4	0.00331	0.00341	0.00369	0.00477	0.00387	0.00420	0.00483	0.00326
5	0.00325	0.00418	0.00408	0.00598	0.00461	0.00533	0.00612	0.00380
6	0.00594	0.00848	0.00780	0.01171	0.00897	0.01069	0.01209	0.00771
Total	1.00000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

County-Level, Saturday 2000 Hourly VMT Fractions Input to MOBILE6

Hour	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
7	0.05585	0.05863	0.05206	0.04292	0.05507	0.05124	0.04361	0.05448
8	0.07463	0.07437	0.06951	0.05525	0.07045	0.06482	0.05571	0.06917
9	0.09800	0.09639	0.09260	0.07082	0.09044	0.08286	0.07130	0.09001
10	0.04242	0.04469	0.04336	0.04858	0.04429	0.04634	0.04740	0.04773
11	0.05027	0.05147	0.05091	0.05620	0.05144	0.05330	0.05515	0.05495
12	0.05637	0.05516	0.05576	0.05989	0.05552	0.05676	0.05885	0.05915
13	0.05928	0.05584	0.05753	0.06007	0.05646	0.05685	0.05902	0.06067
14	0.05962	0.05567	0.05771	0.05976	0.05634	0.05646	0.05886	0.06074
15	0.05940	0.05499	0.05705	0.05863	0.05562	0.05558	0.05770	0.06015
16	0.08082	0.08012	0.08041	0.07685	0.07963	0.07857	0.07707	0.07978
17	0.07972	0.08043	0.08031	0.07810	0.08026	0.07977	0.07823	0.07906
18	0.07902	0.08111	0.08030	0.07756	0.08026	0.07987	0.07750	0.08035
19	0.07442	0.07527	0.07492	0.07202	0.07470	0.07419	0.07170	0.07457
20	0.02535	0.02788	0.03007	0.03797	0.03048	0.03380	0.03903	0.02600
21	0.02183	0.02285	0.02513	0.03057	0.02497	0.02728	0.03142	0.02165
22	0.01962	0.02047	0.02234	0.02782	0.02252	0.02472	0.02863	0.01915
23	0.01682	0.01653	0.01830	0.02217	0.01827	0.01969	0.02285	0.01586
24	0.01359	0.01278	0.01447	0.01696	0.01425	0.01506	0.01736	0.01249
1	0.00904	0.00882	0.00981	0.01177	0.00987	0.01046	0.01186	0.00872
2	0.00620	0.00584	0.00660	0.00758	0.00649	0.00678	0.00761	0.00588
3	0.00524	0.00462	0.00528	0.00605	0.00522	0.00538	0.00610	0.00467
4	0.00331	0.00341	0.00369	0.00477	0.00387	0.00420	0.00483	0.00326
5	0.00325	0.00418	0.00408	0.00598	0.00461	0.00533	0.00612	0.00380
6	0.00594	0.00848	0.00780	0.01171	0.00897	0.01069	0.01209	0.00771
Total	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

County-Level, Sunday 2000 Hourly VMT Fractions Input to MOBILE6

Hour	Harris	Brazoria	Fort Bend	Waller	Montgomery	Liberty	Chambers	Galveston
7	0.05585	0.05863	0.05206	0.04292	0.05507	0.05124	0.04361	0.05448
8	0.07463	0.07437	0.06951	0.05525	0.07045	0.06482	0.05571	0.06917
9	0.09800	0.09639	0.09260	0.07082	0.09044	0.08286	0.07130	0.09001
10	0.04242	0.04469	0.04336	0.04858	0.04429	0.04634	0.04740	0.04773
11	0.05027	0.05147	0.05091	0.05620	0.05144	0.05330	0.05515	0.05495
12	0.05637	0.05516	0.05576	0.05989	0.05552	0.05676	0.05885	0.05915
13	0.05928	0.05584	0.05753	0.06007	0.05646	0.05685	0.05902	0.06067
14	0.05962	0.05567	0.05771	0.05976	0.05634	0.05646	0.05886	0.06074
15	0.05940	0.05499	0.05705	0.05863	0.05562	0.05558	0.05770	0.06015
16	0.08082	0.08012	0.08041	0.07685	0.07963	0.07857	0.07707	0.07978
17	0.07972	0.08043	0.08031	0.07810	0.08026	0.07977	0.07823	0.07906
18	0.07902	0.08111	0.08030	0.07756	0.08026	0.07987	0.07750	0.08035
19	0.07442	0.07527	0.07492	0.07202	0.07470	0.07419	0.07170	0.07457
20	0.02535	0.02788	0.03007	0.03797	0.03048	0.03380	0.03903	0.02600
21	0.02183	0.02285	0.02513	0.03057	0.02497	0.02728	0.03142	0.02165
22	0.01962	0.02047	0.02234	0.02782	0.02252	0.02472	0.02863	0.01915
23	0.01682	0.01653	0.01830	0.02217	0.01827	0.01969	0.02285	0.01586
24	0.01359	0.01278	0.01447	0.01696	0.01425	0.01506	0.01736	0.01249
1	0.00904	0.00882	0.00981	0.01177	0.00987	0.01046	0.01186	0.00872
2	0.00620	0.00584	0.00660	0.00758	0.00649	0.00678	0.00761	0.00588
3	0.00524	0.00462	0.00528	0.00605	0.00522	0.00538	0.00610	0.00467
4	0.00331	0.00341	0.00369	0.00477	0.00387	0.00420	0.00483	0.00326
5	0.00325	0.00418	0.00408	0.00598	0.00461	0.00533	0.00612	0.00380
6	0.00594	0.00848	0.00780	0.01171	0.00897	0.01069	0.01209	0.00771
Total	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000